ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

JUNE 1955

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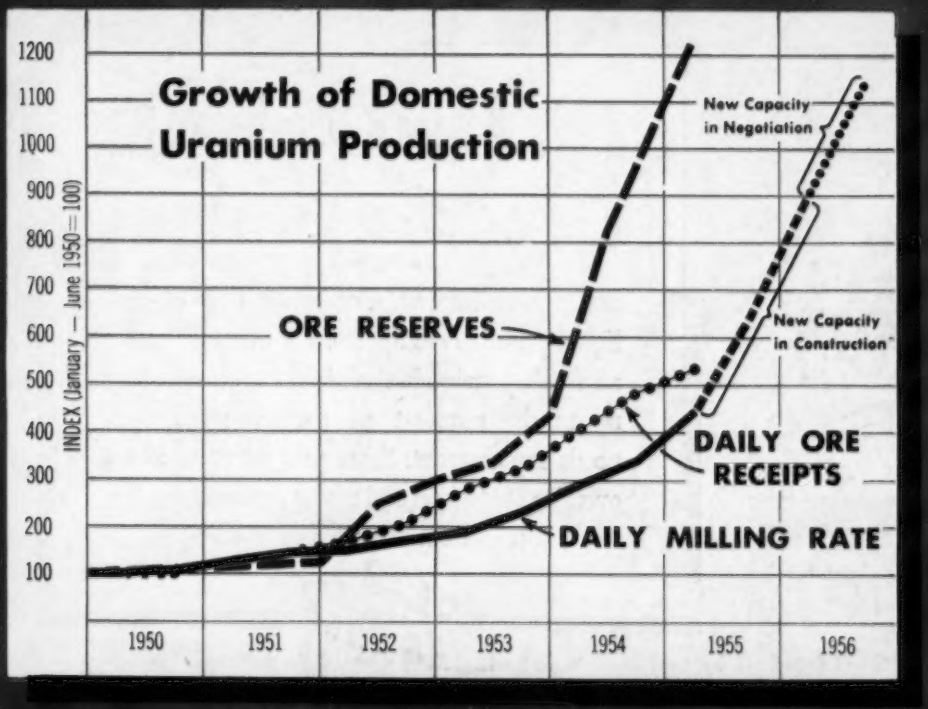
FOUNDED 1866

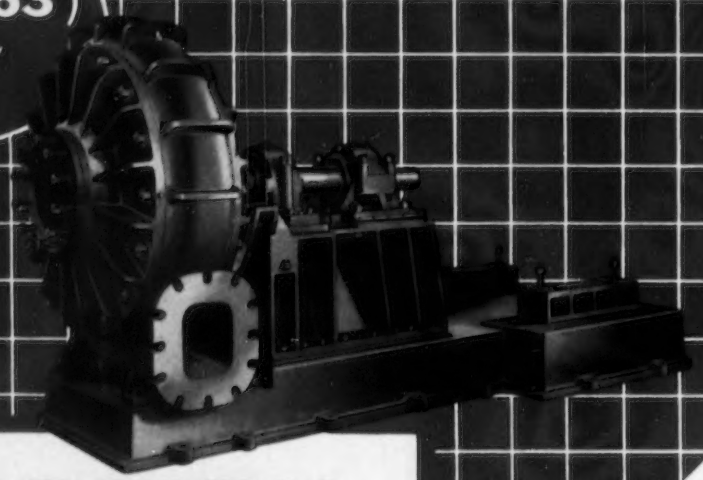
Autogenous Grinding—Its potential and its pitfalls. **p 84**



For more facts and a fresh look at uranium milling policy, **see p 75**

if you are pumping abrasives

3 mesh (.263")
and larger to 6"



HYDROSEAL
Dredge Pumps

merit your interest. Because a flow of seal liquid prevents enlargement of the close clearances, they maintain their initial high efficiency up to the moment an abrasive-worn part needs replacement. Since you never need an oversize Hydroseal and motor as allowance for wear, you can cut your power costs ⅓ to ½.

400 to 48 mesh
100% minus .0116"

INTERCHANGEABLE

HYDROSEAL Slurry Pump
(Sealing water)

***CENTRISEAL* Slurry Pump**
(No Sealing water)

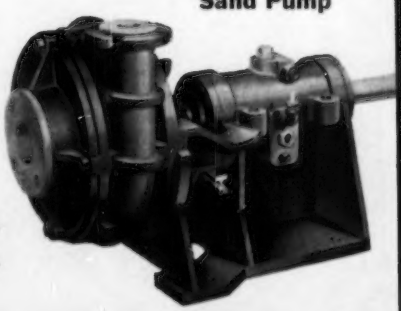
In our Sand and Slurry Pumps all the parts exposed to abrasive action are [illegible] Maximix Rubber. But, since abrasives over ¼" diameter do not bounce off but tend to tear rubber, Hydroseal Dredge pumps have their impellers, shells and suction sleeves made of the alloy most resistant under the wearing conditions. If duty permits, the stationary side plates are of rubber.

Write for Hydroseal Catalog No. 953

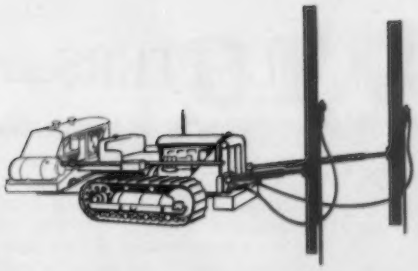
THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

35 to 4 mesh
100% minus 2"

HYDROSEAL
Sand Pump



HYDROSEAL *and CENTRISEAL*
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED



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DRILLING RIG

- *increases production*
- *cuts drilling costs*
- *converts setup time to drilling time*

TAKE a truck or tractor. Add a pair of rugged Ingersoll-Rand Hydra-Boom drill mountings with famous X71-WD Drifters and feeds, a Gyro-Flo compressor—Result!—a self-powered, self-propelled drilling rig that will save man hours and cut by far the number of Jackhamers, wagon drills needed on a rock excavation job.

Hydra-Booms lift, swing, extend and retract under smooth, hydraulic power. Drill towers are spotted where you want them at the throw of a valve. Operators spend their time *drilling rock*—not tugging heavy equipment around on rough terrain.

Actual experience on jobs has shown that Ingersoll-Rand Hydra-Boom Drilling Rigs can cut, by 50% or more, the total cost per foot of hole and double production per shift.

Hydra-Booms are big and rugged—They have larger, more powerful hydraulic cylinders to work at lower pressures—piston packings last longer in heavy-duty service. Short, direct piping from the compressor to the drills eliminates friction losses, pipe line and air hose maintenance and air-line breaks due to freezing, blasting or collisions. There is always maximum air pressure at the drills. Also the service-proved efficiency and dependability of the Ingersoll-Rand Gyro-Flo rotary compressor mean long-range savings in air power costs.

For the complete Hydra-Boom story, see your nearest I-R representative or write to Ingersoll-Rand for Bulletin No. 4169.

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ENGINEERING AND MINING JOURNAL

89th YEAR OF PUBLICATION

VOL. 156 No. 6

JUNE 1955

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LETTERS

Guidebook Comments

Your Mid-March 1955 edition of the Mining Guidebook deserves favorable comment for its over-all treatment of the engineering and mining fields, and we are particularly pleased with the way you presented our products under Flotation Reagents.

We do wish, however, to call your attention to an inaccuracy appearing on p 67 which lists Philadelphia Quartz Co. as manufacturer of Dowfroth 250. This is indeed in error, and should be corrected. Presumedly the code should have been (Y) referring to Dow Chemical Co. instead of (V).

C. R. Mulloy
Philadelphia Quartz Co.

Titanium Costs

I have read Dr. Kellogg's article "What the Future Holds for Titanium" in the April issue of *E&MJ*, and find it very interesting and timely. I do not agree with some of his specific estimates, for example, reduction and magnesium electrolysis investment costs. I believe the article gives a good over-all evaluation of future prospects for the industry.

In conclusion I wish to state that Dr. Kellogg has done a very good job and even though everyone probably will not concur with all of his guesses and estimates I am sure everyone will agree that his over-all analysis discloses that titanium metal can eventually be produced at lower prices.

F. J. Cservenyak
U. S. Bureau of Mines

Guidebook Correction

In the article "What to Expect of Modern Pumps" by W. B. Stephenson, which appeared in the *E&MJ Mining Guidebook*, Mid-March 1955, several "equal" and "plus" signs were omitted. The copy, which appeared on pp 91 and 92, should read as follows:

US gpm of pulp =

$$T \times 0.1675\left(\frac{W}{R} + \frac{1}{\text{Sp. Gr.}}\right)$$

Where T = tons (2000#) per 24 hours
W = % by weight of water
R = % by weight of solids
sp. gr. = specific gravity of solids

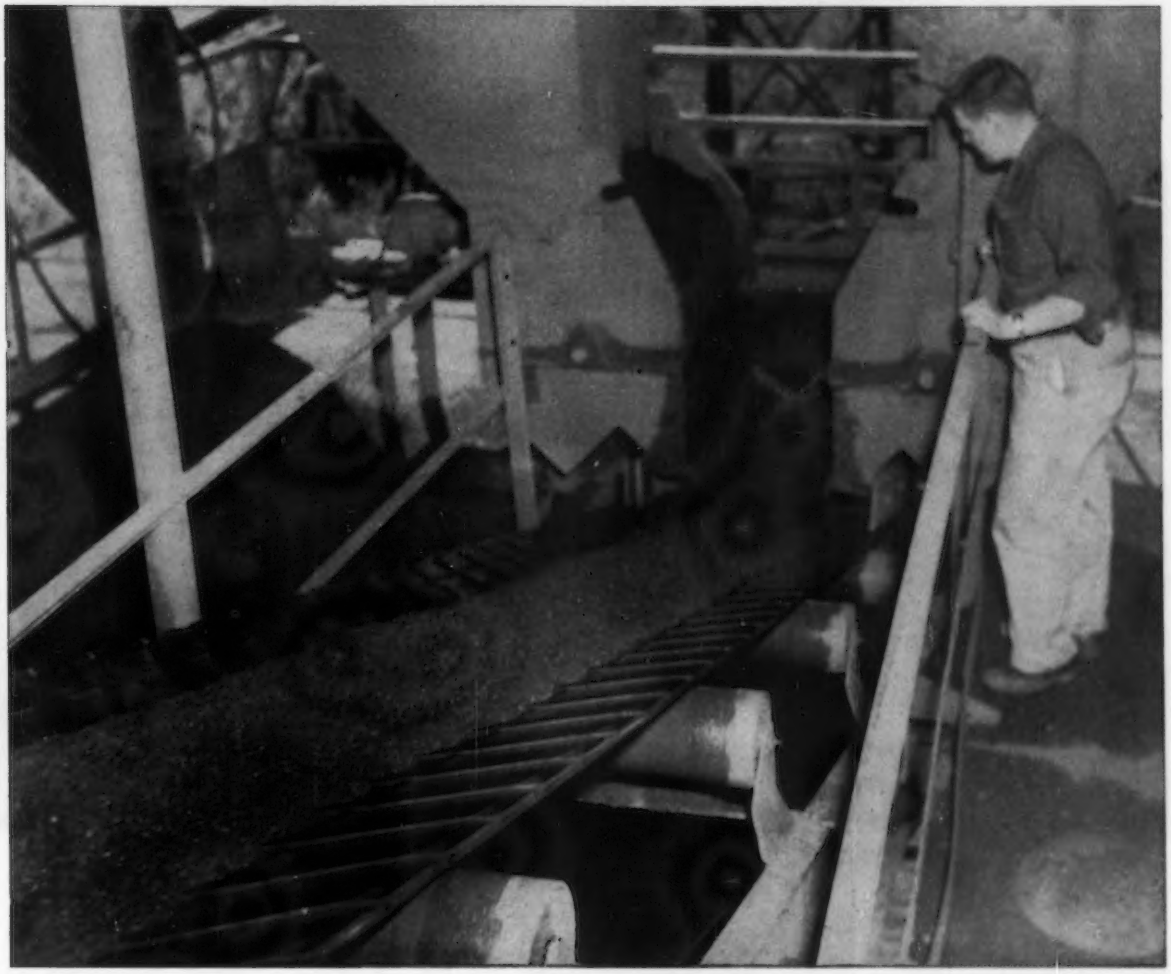
length of suction pipe is 86 + 14 = 100 ft.

Friction loss from Table IV is 1.7 ft of water per 100 ft of pipe. Velocity head is almost 0.5 ft and static suction lift is 8 ft. Hence, suction lift is 8 + 1.7 + 0.5 = 10.2 ft.

Concentration of solid by weight has a direct bearing on friction losses as we go above 40% and materially affects friction losses in the brackets above 65%.

One practice is to increase the rate to the equivalent of C = 100 at 50-55% and to go as high as C = 65.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Rubber belt drains off water to speed ore washing

RIDING up that conveyor belt is crushed iron ore, still sopping wet from the washing that removes sand or silica.

As you can see, this is no ordinary belt. If it were, water seeping down through the ore would form a pool at the bottom of the belt trough, and wash the ore down the 20° incline. That's why the Riffle Grip belt you see here was recommended by B. F. Goodrich.

You'll notice that the Riffle Grip belt has a series of rubber ridges molded into the cover. It's this tread with angular steps that holds the ore in place, and, at the same time, channels water to the edges of the belt where it flows off.

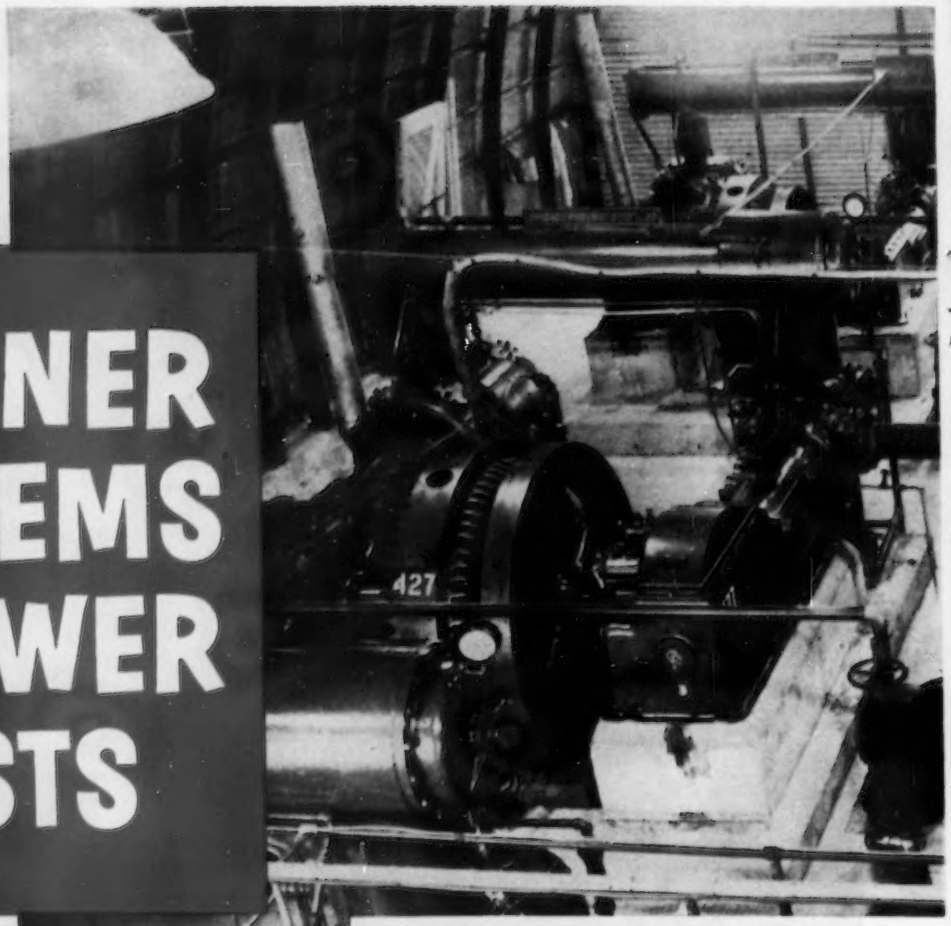
B. F. Goodrich engineers developed this belt to solve a gold dredging problem. And it is such an improvement over ordinary belts that it's now widely used in mining operations, sand and gravel plants, and other places where wet materials must be carried up steep inclines.

This same belt works equally well on jobs where moisture must be *held*. By changing the incline angle and the troughing idlers, the steps become a series of horizontal ribs which can carry such sloppy materials as wet mixed concrete and keep the water from draining away.

With its ability to shed water or retain it, as the job requires, the B. F. Goodrich Riffle Grip belt is making many mining and processing jobs cheaper, more efficient. Your BFG distributor will give you complete details on how this unusual belt can solve your wet material handling problems. Or write *The B. F. Goodrich Company, Dept. M-439, Akron 18, Ohio.*

B.F. Goodrich
INDUSTRIAL PRODUCTS DIVISION

CLEANER SYSTEMS ... LOWER COSTS



BY LUBRICATING your air compressors with *Texaco Regal Oil R&O*, you'll keep rust and harmful deposits out of the system, assure clear lines, free piston rings, proper valve action. You'll have cleaner, more efficient operation . . . reduce maintenance costs.

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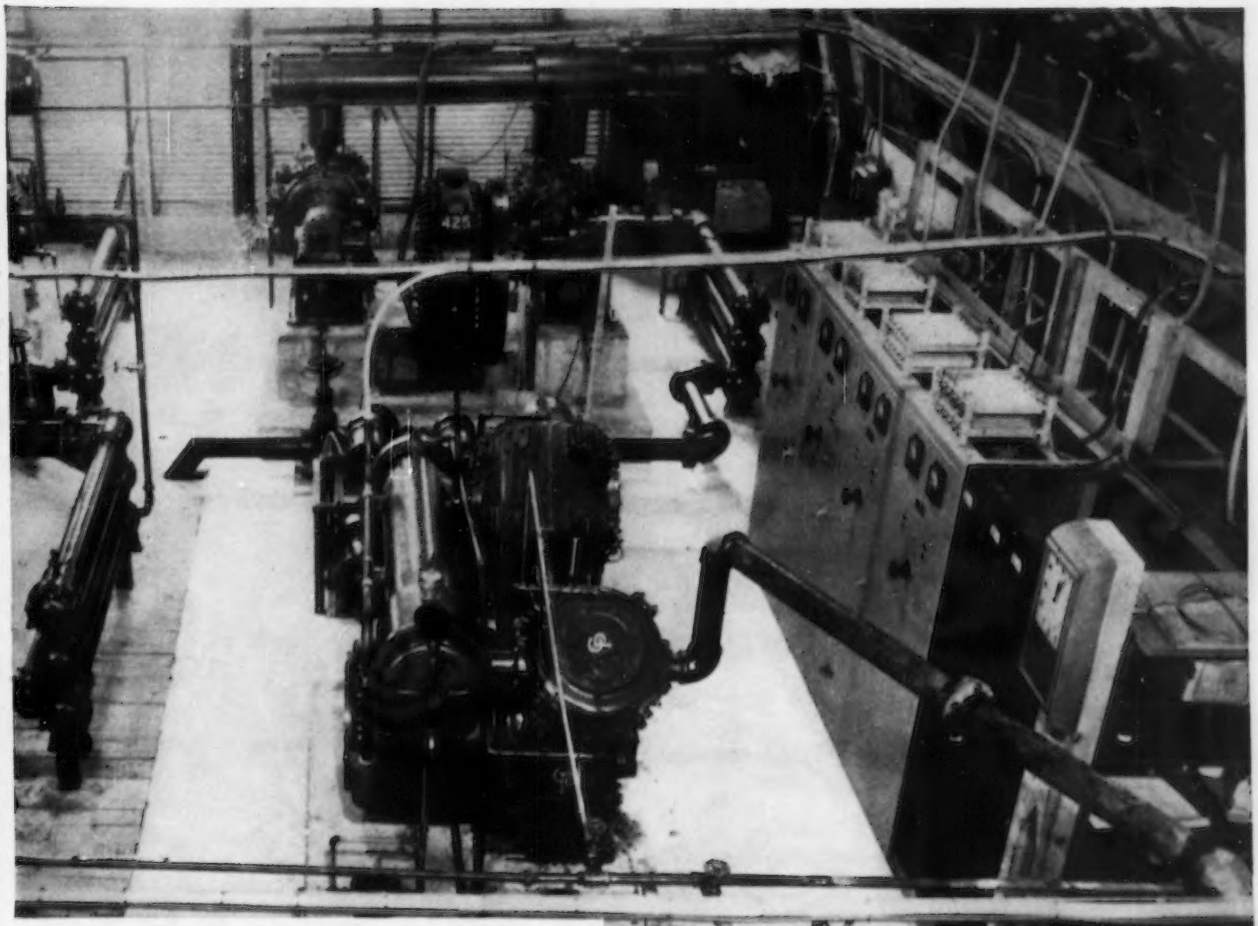

sure, whatever the operating conditions.

For your drills, use *Texaco Rock Drill Lubricant EP*. Its effective extreme pressure properties minimize wear—and your drills will be protected against rust whether running or idle. Count on it for longer drill life, lower maintenance costs.

Let a Texaco Lubrication Engineer help you select the proper lubricants to step up the efficiency of all your equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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FOR THE MINING INDUSTRY

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Subsidiaries: JOHNSON
PARSONS · KWIK-MIX

BIG-PRODUCTION TEAM — Loading rock, Koehring 1½-yard shovel (above) is teamed up with Koehring Dumpters.®

Measure excavators by

price per pound of lifting capacity

In analyzing shovel operation, you will find that price per pound of lifting capacity on crane rating is also an excellent measurement of excavator value.

Remember, lift capacity is *work capacity*. Obviously, the machine with the heaviest lift rating not only picks up larger crane loads — it also has more strength, extra speed and stability to handle bigger loads faster with every excavator attachment.

Check Koehring lift ratings shown below — then ask your Koehring distributor to give you the figures on price per pound of lifting capacity.

Compare for yourself:

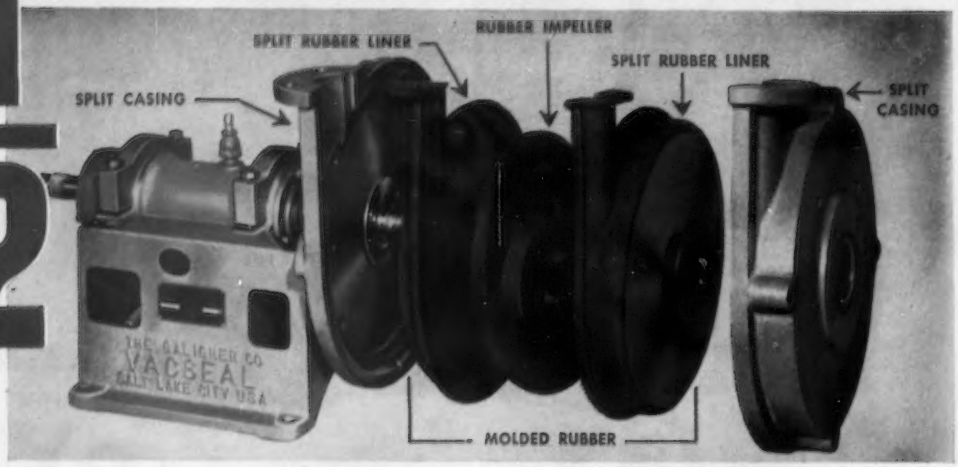
KOEHRING MODEL	SIZE DIPPER	KOEHRING LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load)		PRICE PER POUND OF LIFT CAP.*
205 CRAWLER	½-Yd.	20,000 lbs.	30-foot boom at 10-ft. radius	?
205 ON RUBBER	½-Yd.	30,000 lbs.	25-foot boom at 12-ft. radius	?
304 CRAWLER	¾-Yd.	27,800 lbs.	35-foot boom at 12-ft. radius	?
304 ON RUBBER	¾-Yd.	50,000 lbs.	30-foot boom at 10-ft. radius	?
405 CRAWLER	1-Yd.	40,000 lbs.	40-foot boom at 12-ft. radius	?
605 CRAWLER	1½-Yds.	72,300 lbs.	50-foot boom at 12-ft. radius	?
1005 CRAWLER	2½-Yds.	159,000 lbs.	50-foot boom at 12-ft. radius	?

*Figures available on request—ask your Koehring distributor to see them.

KOEHRING HEAVY-DUTY

K491

1½" VACSEAL PUMP



Latest addition to the Famous VACSEAL Family

The 1½" VACSEAL pump embodies all the fine features of the larger VACSEALS, plus replaceable molded rubber liners — tailor-made of the right type rubber to handle your specific material, even under adverse conditions of temperature, abrasion and/or corrosion.

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SPLIT CASING and split liner simplify replacement and provide low-cost maintenance. The rubber liner is non-collapsible, a feature that eliminates flutter and increases liner life.

GLAND operates dry without sealing water.

ACID PROOFING — furnished at no extra cost.

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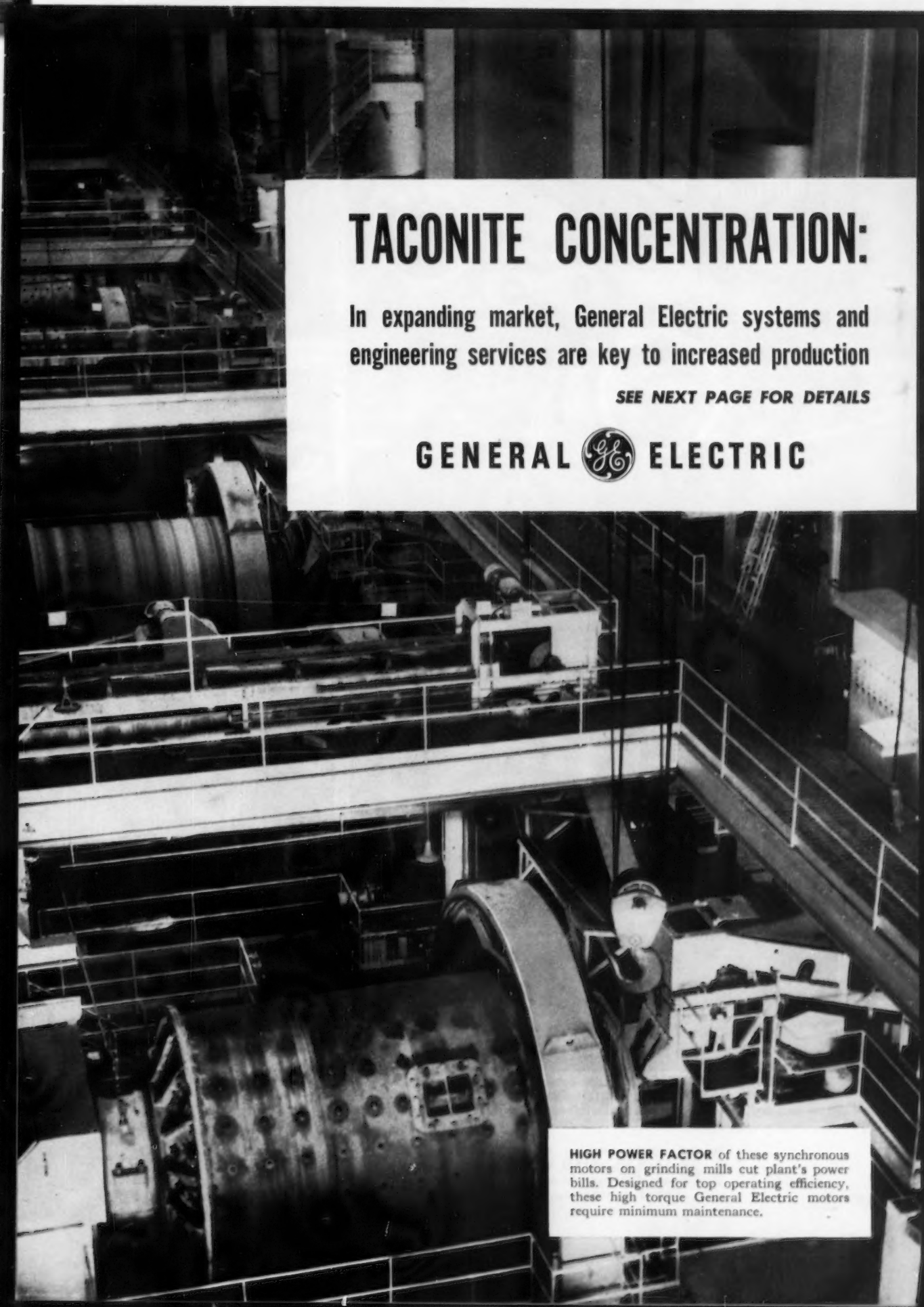


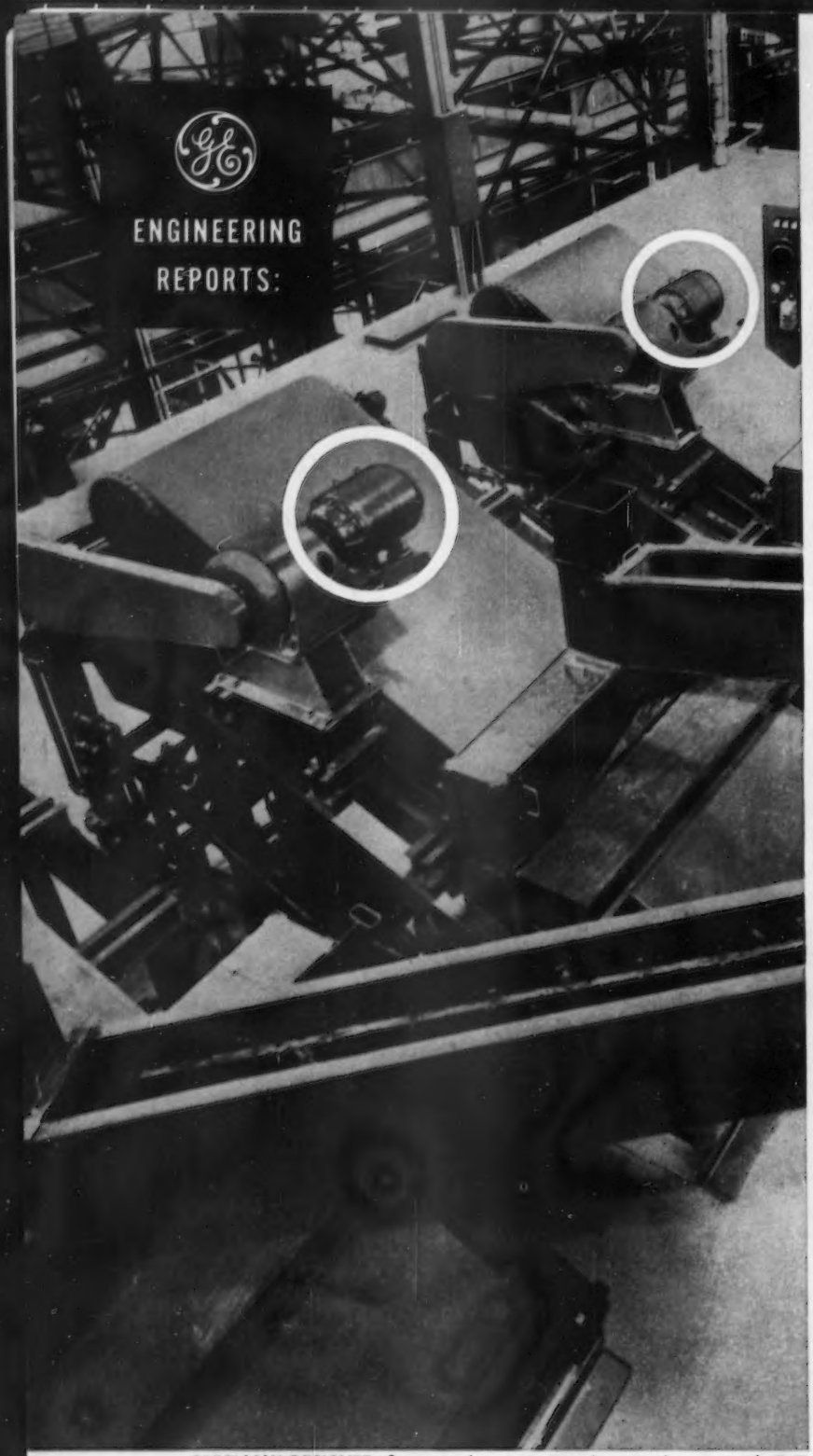
TACONITE CONCENTRATION:

In expanding market, General Electric systems and engineering services are key to increased production

SEE NEXT PAGE FOR DETAILS

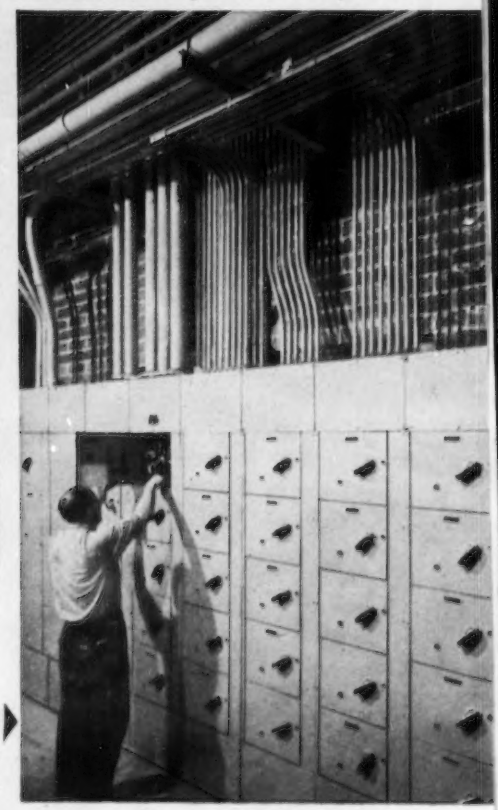
GENERAL ELECTRIC

HIGH POWER FACTOR of these synchronous motors on grinding mills cut plant's power bills. Designed for top operating efficiency, these high torque General Electric motors require minimum maintenance.



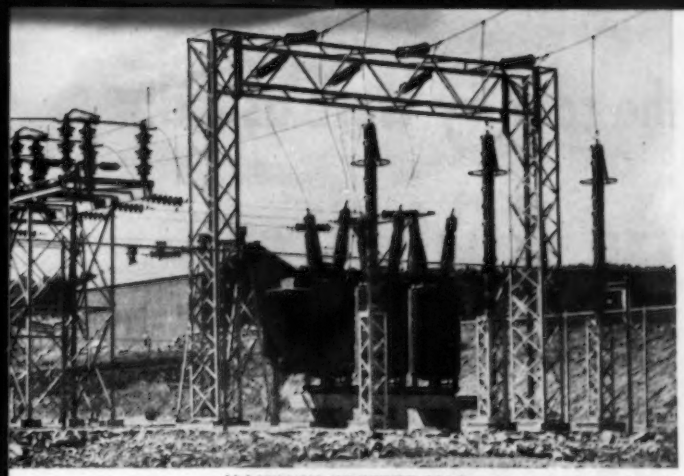
SPECIALLY-DESIGNED for taconite concentration service, rugged G-E Tri-Clad* motors have been fully tested in the taconite field. These totally enclosed, fan-cooled motors are built for long operating life and a minimum amount of maintenance.

EXPERIENCED G-E ENGINEERS save you time and money in the planning, delivery, and installation of your electrical system.

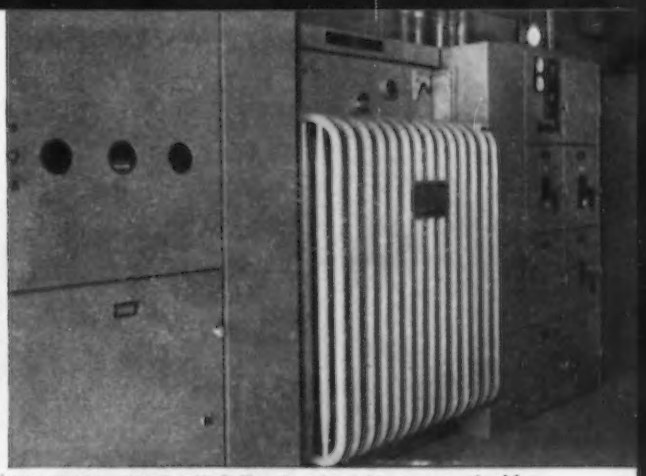


EASY-TO-INSTALL G-E Cabinetrol* control centers are delivered factory assembled. Located in ventilated control rooms, they give centralized control for plant operations.

*Reg. trade mark of General Electric Co.



MAXIMUM PROTECTION for concentration plant's distribution system is assured by G-E packaged substations. They are designed with standard components to meet individual requirements



COMPLETE, COMPACT G-E unit substations save valuable floor space. They provide power for round-the-clock operation of plants. Factory assembled, they are easy to install and can be expanded with ease.

G-E electrical systems and engineering services help

INCREASE TACONITE CONCENTRATE OUTPUT

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Field Engineers are available to assist with the installation and start-up of your electrical system.

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These G-E engineering services are designed to help you get the best electrical system for your particular needs. They will also save you time and money in the ordering, delivery, and installation of your electric equipment. For more information about G-E electrical systems and services, contact an Apparatus Sales Representative at your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. 660-32

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HD-21 and HD-16
with Torque Converter* Drive

The new Allis-Chalmers HD-21 and HD-16 Crawler Tractors are designed and built to meet extremely high performance requirements — while maintaining the rigid Allis-Chalmers standard for longer life and the ability to operate at low cost.

Many outstanding features are being introduced by Allis-Chalmers on the HD-21 and HD-16, including • all-new A-C Diesel engines with "follow-through" combustion, for greater work with low loading of engine parts and extra long overall engine life • new Tru-Dimension track, featuring greater weight and maximum toughness • new "Wrap-around" radiator guard which tilts forward and down for easy accessibility • *Twin Disc Torque Converter Drive as standard equipment on the HD-21; optional equipment on the HD-16 . . . designed by Twin Disc and Allis-Chalmers engineers to meet exclusive requirements of the HD-21 and HD-16.*

Twin Disc Torque Converter Drive was also standard equipment on the HD-21's predecessors . . . for since 1940, it has been a feature on A-C Crawler Tractors.

***and the Torque Converter is Twin Disc**

Since 1937, Twin Disc Clutch Company has specialized in Torque Converter Drive for powered industrial equipment. Crawler tractors represent one of the most successful applications.

By applying the crawler tractor's horsepower and torque through the cushioned drive of fluid, Torque Converter Drive permits peak utilization of horsepower and prevents engine lugging — provides smoother, easier, more flexible operation with minimum clutching and shifting — promotes faster work cycles and more production per day.

TWIN DISC

TWIN DISC
Torque Converters

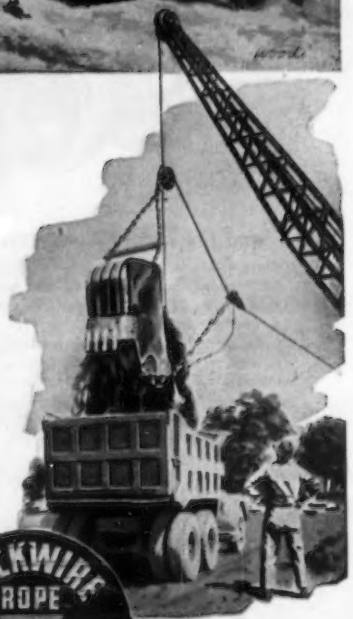
Twin Disc Clutch Company, Racine, Wisconsin
Hydraulic Division, Rockford, Illinois

the dirt flies faster—now with MUSCLES OF STEEL

Straining laborers plying pick and shovel are a bygone memory because of today's excavating and road-building equipment. Modern power shovels and draglines use *muscles of steel*—rugged wire rope—to keep the dirt flying fast.

Helping to clear the way for needed highways is another of the important ways in which Wickwire Rope contributes *muscle* to America's might.

You'll find Wickwire Rope, too, in the mines and the quarries . . . in the oil fields and logging camps . . . with the fishing fleets . . . and in numerous materials handling operations. Whatever the job may be, the extra care and quality fabrication that goes into Wickwire Rope proves itself in longer life, more economical service and utmost reliability.



every industry benefits from wire rope

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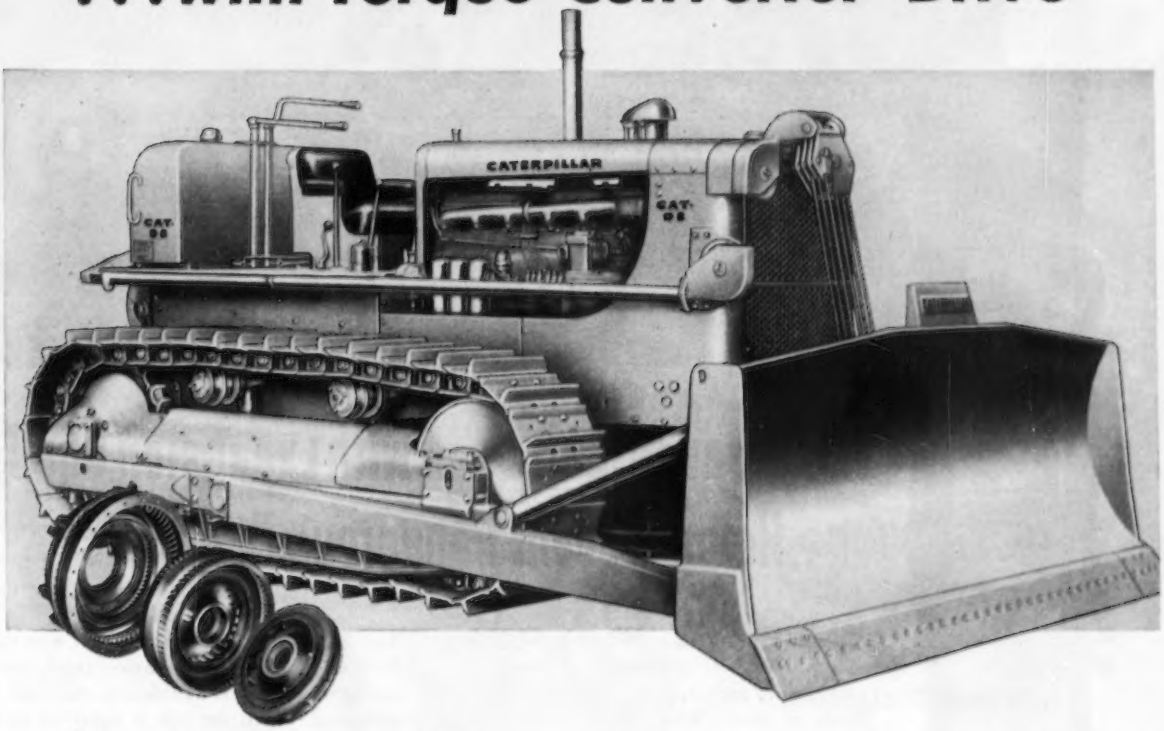
2 NEW CAT DIESEL TRACTORS D8 and D9

. . . with Torque Converter* Drive



***and the Torque Converter is Twin Disc**

Since 1937, Twin Disc Clutch Company has specialized in Torque Converter Drive for powered industrial equipment. Crawler tractors represent one of the most successful applications.

By applying the crawler tractor's horsepower and torque through the cushioned drive of fluid, Torque Converter Drive permits peak utilization of horsepower—provides smoother, easier, more flexible operation with minimum clutching and shifting—promotes faster work cycles and more production per day.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC
Torque Converters

Twin Disc Clutch Company, Racine, Wisconsin
Hydraulic Division, Rockford, Illinois

The new Caterpillar D8 and D9 Diesel Tractors are built to deliver an even higher standard of money-making production, on *any* track-type application in *any* field.

Many advance-design features are engineered into these powerful Cat-built machines, including new Cat Diesel Engines with an all-new fuel injection system; new 7-roller track frames for maximum stability, flotation, and better ride; new "Water-quenched" track shoes for longer life than ever before; Hydraulic Booster Steering for maximum steering ease; new starting engines with more power; "In-seat" starting for greater convenience . . . *and Twin Disc Torque Converter Drive as optional equipment on both the Cat D8 and D9 Diesel Tractors . . . developed by Twin Disc and Caterpillar engineers to match the precise power characteristics of the new D8 and D9.*

This Headed Bolt, Used with Expansion Shell, Helps Prevent Dangerous Roof Falls

Danger from serious roof falls is greatly reduced when you install roof bolting. For roof bolting anchors overlying rock, keeps it firmly in place. What's more, it improves ventilation, as there are no old-fashioned, bulky supports to hinder air-flow. Less storage space is needed, above and below ground. Installation is accomplished in less time, and at low cost. And there's much more space in which to operate mechanical equipment.

To help operators obtain these ideal operating conditions, Bethlehem produces the square-head bolt illustrated here. It is made in three types: (1) a ¾-in. carbon-steel bolt, having a typical breaking load of 24,000 lb, (2) a ⅝-in. high-strength bolt, also with a typical breaking load of 24,000 lb, and (3) a ⅞-in. high-strength bolt, with a typical breaking load of 45,000 lb.

The ¾-in. and ⅝-in. bolts are used with the Bethlehem Type C expansion shell, consisting of a 4-leaf malleable-iron shell and a steel plug. When the bolt is tightened in a 1⅜-in. diam hole, the plug is drawn down on the threads, expanding the leaves of the shell so that they lock against the sides of the hole.

Bethlehem also furnishes a hardened washer for use with these square-head bolts. It reduces the friction between the bolt head and the roof plate that occurs when high tension in the bolt produces excessive bearing pressure. The washer permits free use of impact wrenches, without galling or tearing of metal.

If you would like additional information about how roof bolting can prevent dangerous roof falls in your mine, just get in touch with the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM MINE ROOF BOLTS

BETHLEHEM STEEL

INTERNATIONAL TD-24

with Torque Converter* Drive

For the largest earthmoving projects . . . for laying big pipe faster and surer . . . for attaining new highs in logging production . . . I-H has developed the new INTERNATIONAL TD-24 Torque Converter Crawler Tractor.

Among the many features offered in the new TD-24 are *fingertip hydraulic control* with INTERNATIONAL'S famous Planet Power Steering; *instantaneous high-low range shift,* with all transmission shifting done by just *one* gear shift lever; the exclusive *"Decelerator"* feature, which gives the operator complete control of engine speed at all times; and *Twin Disc Torque Converter Drive* as *optional equipment . . . tailored by Twin Disc and International engineers to the TD-24's exact characteristics.* TWIN DISC CLUTCH COMPANY, Racine, Wisconsin; Hydraulic Division, Rockford, Illinois.

***and the Torque Converter is Twin Disc**

Since 1937, Twin Disc Clutch Company has specialized in Torque Converter Drive for powered industrial equipment. Crawler tractors represent one of the most successful applications.

By applying the crawler tractor's horsepower and torque through the cushioned drive of fluid, Torque Converter Drive permits peak utilization of horsepower and prevents engine lugging—provides smoother, easier, more flexible operation with minimum clutching and shifting—promotes faster work cycles and more production per day.

TWIN DISC

TWIN DISC

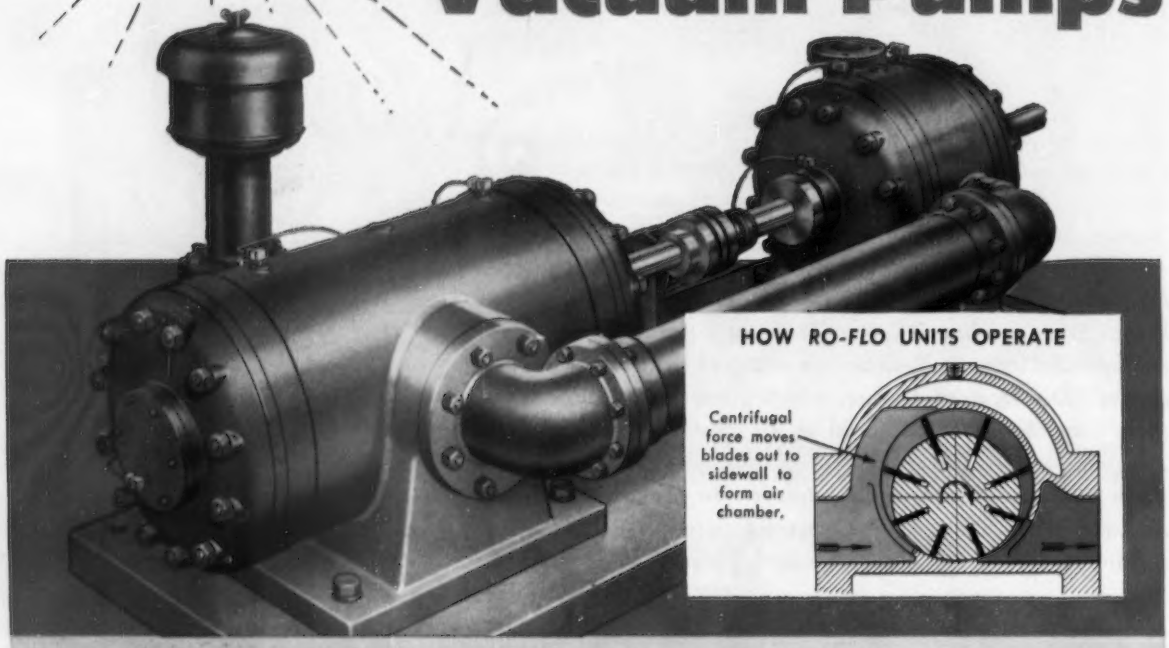
Torque Converters

ALLIS-CHALMERS

NEW

100-lb Compressors

0.3-in. Mercury Absolute Vacuum Pumps



FOR SHOP AIR • DRILLING • GAS HANDLING • VACUUM PUMPING

Now—the *Ro-Flo* line is extended to include high pressure as well as low pressure units to give you three important advantages:

Constant efficiency —Automatic compensation for wear is inherent in *Ro-Flo* design. During operation, rotor blades slide against the sidewall to form air cells. Any blade wear from this action is compensated for by the rotating force which holds blades in contact with the cylinder.

Simple foundation requirements—The smooth rotation of the *Ro-Flo* unit cuts vibration and eliminates need for heavy, expensive foundations.

Low maintenance —Shock and vibration, inherent in reciprocating machines, is eliminated. This cuts maintenance.

Two-stage *Ro-Flo* compressors can be furnished in any of 12 sizes to handle from approximately 250 to 1800 cfm at pressures from 65 to 125 pounds gauge. Vacuum pumps furnished from 200 to 5040 cfm at 29.7 inches Hg vacuum, with shut-off of 29.9 inches Hg, referred, or better. Single-stage units are built for pressures up to 50 pounds gauge, 65 pounds absolute. Single-stage pumps for vacuums up to 28 inches Hg referred.

A-4569

GET INFORMATION

Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Ro-Flo is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

The entire shell of the bucket on this 50-cu. yd. power shovel is fabricated from ¾" and 6½" "T-1" Steel Plate. Liner plates are made of ½" "T-1" Steel. "T-1" Steel Plate only 6½" thick has replaced large castings a foot thick in the lip of the bucket. Lighter weight construction with "T-1" Steel made it possible to increase the cubic capacity of the bucket by ten yards.

How USS "T-1" STEEL in big machines

cuts weight, cuts cost, increases service life

Hanna Coal Company just can't afford to have this giant 50-cu. yd. shovel break down. This machine can move 2,280,000 tons of material a month, and it must operate continuously—24 hours a day, 7 days a week—to pay off.

Strong, weldable "T-1" Steel has improved the performance of this incredibly rugged machine, and it also has cut cost and weight. It enables the designers to use *fabricated* parts in place of larger, heavier, more expensive castings. And these lower-cost fabricated parts actually *last longer* than castings. As a result, Hanna Coal Company has standardized on "T-1" Steel for the vital parts of much of its heaviest-duty equipment.

Write for complete information on new USS "T-1" Steel. It has application in pressure vessels, rotating machinery, structural steel towers, steel mill equipment, big trucks, mine cars, and elsewhere.

WHAT'S "T-1" GOT?

AT HIGH TEMPERATURES. "T-1" has good creep rupture strength up to 900° F. and is being used with great success in heavy-duty, high temperature applications.

AT LOW TEMPERATURES. "T-1" is amazingly tough at temperatures far below zero . . . has withstood impacts of 2,000,000 ft. lbs. at 38 degrees below zero.

IN FABRICATION. "T-1" can be welded or flame cut without pre- or post-heating . . . and the welds develop the full 90,000 psi yield strength.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

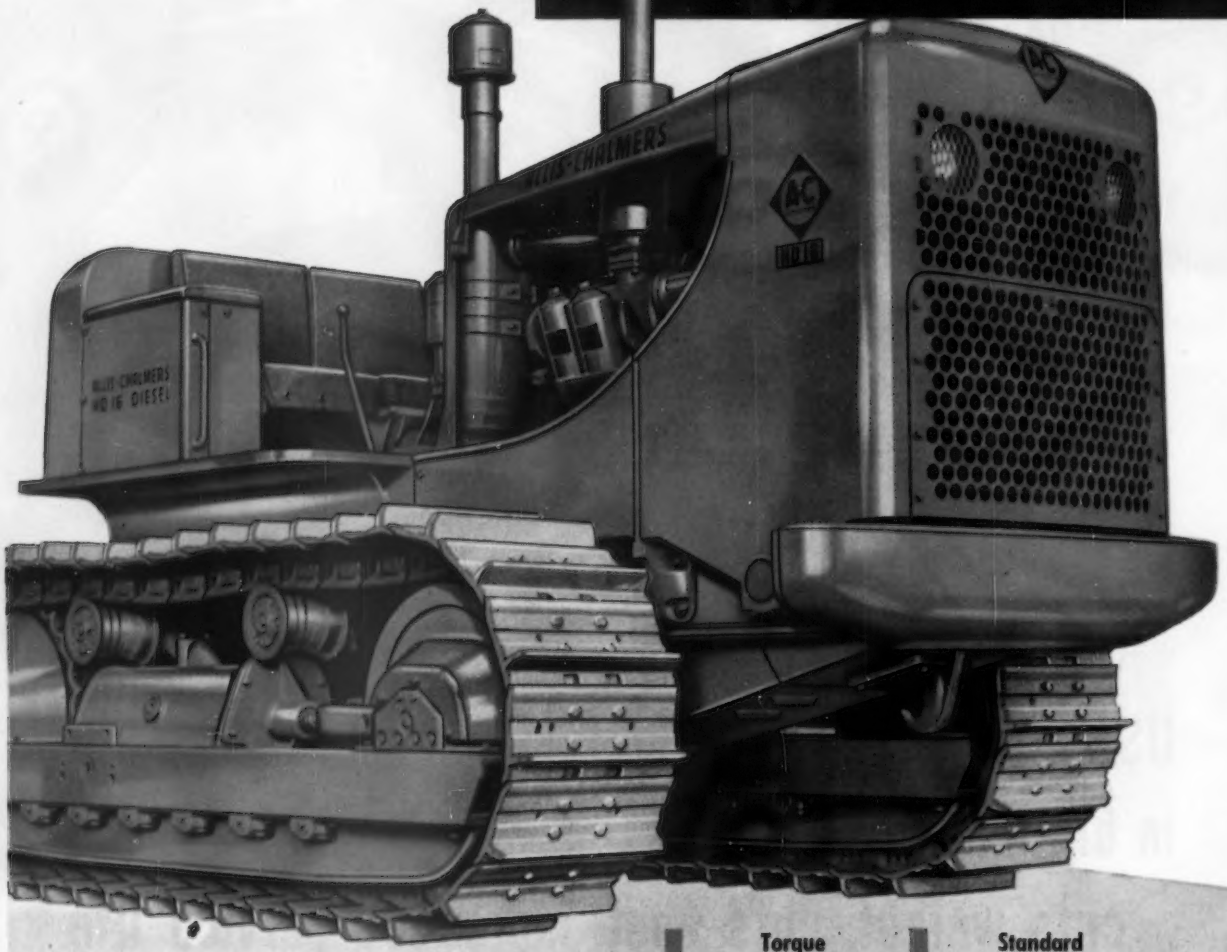
USS "T1" CONSTRUCTIONAL ALLOY STEEL

USS

S-475

UNITED STATES STEEL

Allis-Chalmers presents the NEW HD-16



Your choice of two outstanding drives

	Torque Converter Drive	Standard Transmission Drive
Horsepower	150 net engine hp	131 belt hp
Weight	31,600 lb	31,500 lb
Drawbar pull	up to 60,000 lb *	up to 35,945 lb *

*Limited, under normal tractive conditions, to 90 percent of total weight of tractor and mounted equipment.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

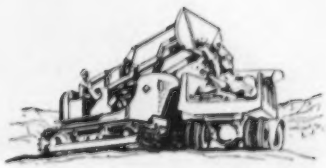
NEW STANDARDS OF PERFORMANCE

for a wide range of heavy-duty work

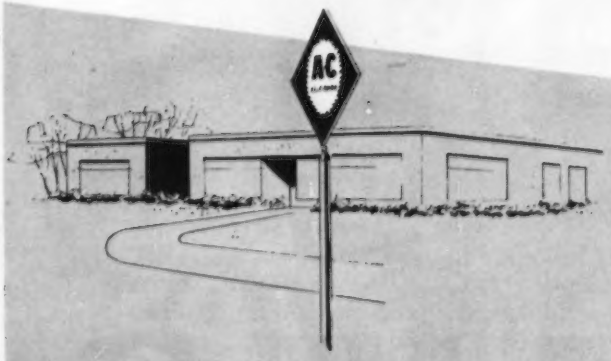
Set your sights on an HD-16! This big new tractor not only brings you *more* power for bigger jobs . . . it makes more effective use of horsepower, with a brand new Allis-Chalmers diesel engine and your choice of two new drives — the job-proved torque converter or the easy-shift standard transmission. Either way, the HD-16 brings you a new high in tractor-operator efficiency . . . a new high in work done under even the toughest conditions.

NEW STANDARDS OF DEPENDABILITY AND LONG LIFE

under *all* conditions!



The HD-16 follows the Allis-Chalmers *advanced basic design*, with such important features as its all-steel, Box-A main frame and one-piece steering clutch and final drive case . . . straddle-mounted final-drive gears with tapered roller bearings . . . unit construction . . . simplified lubrication and service designed with *better* maintenance in mind. What's more, it is newly engineered throughout to provide big safety factors in all components . . . plus outstanding new features like the new Allis-Chalmers heavy-duty diesel engine, new "wrap-around" radiator guard, husky new transmissions, new true-dimension track, and many others.



All in all, the new Allis-Chalmers HD-16 brings you an outstanding combination of performance and long life with both mounted and drawn equipment . . . a higher rate of production, more working time, more work done, LOWERED JOB COSTS. You OWE it to yourself to get all the facts now from your nearby Allis-Chalmers dealer.

ROEPRENE MINING CABLE

Flexible tinned copper conductors insulated with rubber or synthetic rubber compound
Braided copper grounding conductor
Yarn reinforcing braid
Yarn reinforcing braid
Conductors cabled together
ROEBLING 6 AWG P-111
ROEBLING 2 AWG P-111 EM 1955
EM 1955

ROEPRENE Mining Cables are approved by the Pennsylvania Bureau of Mines Approval P-111, and comply with the requirements of the U.S. Bureau of Mines for flame resistance.

YOU WANT

FLEXIBILITY,
EXTREME TOUGHNESS,
RESISTANCE TO WATER,
OIL AND OZONE,
MAXIMUM LIFE...
IN SHORT,

YOU WANT

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

STURTEVANT ROTARY FINE CRUSHERS

Crush or Granulate to Fine, Even Sizes without Excess Dust...

Cross section view illustrating the crushing action

These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

STURTEVANT MILL COMPANY
101 CLAYTON STREET, BOSTON 22, MASSACHUSETTS
Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

CLIP AND MAIL COUPON TODAY

Sturtevant Mill Company
101 Clayton Street
Boston 22, Massachusetts

Gentlemen:
Please send me catalog describing your Rotary Fine Crushers. I am interested in crushing _____

Name _____

Street _____

City & State _____

Firm _____

Welder is shown welding a "wear-sharp" repointer to the shank of a dipper tooth using the Amsco MF and flux.

HARDFACE WITH THE AMSCO® MF

for manual flexibility . . . plus machine speed and accuracy

The Amsco MF combines the visibility and craftsmanship of hand welding with the automatic advantages of machine work. Speed of hardfacing increases because the Amsco MF uses small-diameter electrode and high-current densities which allow the operator to maintain a high deposit rate. The electrode feed is continuous—and automatically regulated—to maintain a constant arc. Thus, the machine automatically *compensates* for operator movement or an irregular welding surface.

Cost of deposited metal is less! The Amsco MF uses coiled, bare mild steel electrode. It feeds through the flux hopper (the cone). There it is magnetically coated with your choice of manganese steel build-up or hardfacing alloy which is carried in the flux. You coat your electrode as you weld at considerable savings in deposit cost.

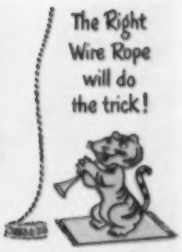
The machine is portable. It plugs into any standard welding unit, and requires no special setup. See a demonstration of the Amsco MF's speed, quality of weld and uniform deposit. Try it yourself and discover how easy it is to operate. Your Amsco Distributor is ready to show it to you now. Welding products are distributed in Canada by Canadian Liquid Air Co., Ltd.

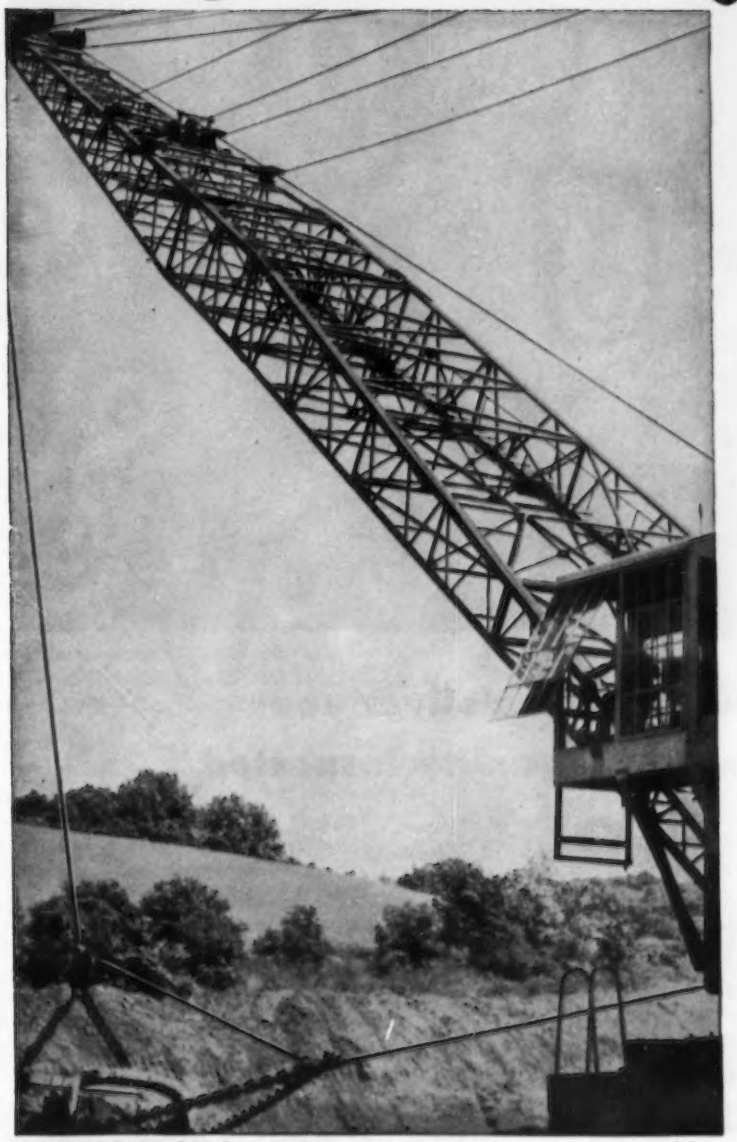
make your Amsco Distributor HARDFACING HEADQUARTERS

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

TROUBLE-FREE SERVICE around the clock from Tiger Brand Drag Rope





ASSURE YOURSELF of good service from your wire ropes—consult an American Wire Rope Engineer regularly.

ONE of the largest coal companies in Pennsylvania gets excellent service from Tiger Brand Wire Rope. On this big dragline, for example, 2¼" Tiger Brand Drag Rope lasts for 8 to 12 weeks, and 1⅜" Tiger Brand Hoist Rope lasts 4 to 6 months. This is good service, because these ropes work 24 hours a day, 6 days a week, every week of the year.

As a result of consistently good service records like these, many such operators use Tiger Brand Wire Rope exclusively on all their excavating machinery.

Like hundreds of other companies that do a lot of excavating, you will find that once you start using Tiger Brand Wire Rope, you keep down rope costs, keep down rope trouble, and *keep on using* Tiger Brand.

For a list of Tiger Brand Wire Ropes and the jobs each one can do best, send the coupon.

FREE ROPE BOOKLET

American Steel & Wire
Dept. C-65, Rockefeller Building
Cleveland 13, Ohio

Please send me, without obligation, a copy of your helpful wire rope selection guide, "The Right Rope for the Job."

Name .....

Company .....

Address .....

City & State .....

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL

61,167 gauges . . . to deliver your Crane Valves 100% quality inspected

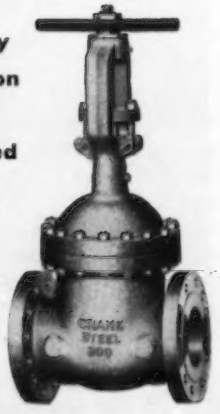
Care-how! A newly coined catch-phrase? Not at Crane! It is a rigidly-adhered-to principle of quality control—100 years old!

By way of example, the Crane technician in the photograph is checking the taper, size and guide slot alignment on gate valve discs. Every disc must correspond to the setting of the indicators—to tolerances of .001 inch plus or minus, on the taper, and .008 inch on the alignment of the slot guides. And Crane uses 61,167 gauges to insure dimensional accuracy.

Why this Care-how? To assure you of smoother, longer lasting valve operation, with lower maintenance and repair costs.

There you have the reasons why knowing and thrifty buyers prefer Crane valves . . . why industry uses more Crane valves than any other make! And the reasons why you should always buy Crane. Crane Co., General Offices, 836 S. Michigan Ave., Chicago 5, Illinois. Branches and Wholesalers serving all industrial areas.

Better Quality
Bigger Selection
in Valves
for Every Need



CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

100 miles per day

for general clean-up tractor at large Eastern quarry

OPENED 40 YEARS AGO, THE QUARRY NOW PRODUCES 15,000 TONS OF MATERIAL DAILY

Most is put through large primary crusher on the following schedule:

DAY SHIFT

1. Limestone: bulk of tonnage shipped by rail.
2. Undersize stone: part made into agricultural lime; balance used for commercial stone.

NIGHT SHIFTS

3. Commercial stone: sold locally for highway and concrete work.
4. Sand: sold locally for highway and concrete work.
5. Rip-rap stone: supplied primarily to railroads.
6. Removal of overburden varying from 6 inches to 40 feet in depth. About half is stone suitable for local sales; the rest, low-quality stone and dirt, is dumped into worked-out sections of quarry.

Thousands of tons of limestone and overburden are removed daily from this Eastern pit, one of the largest quarries in the country. Recently, to speed clean-up on the several hundred acre spread, the quarry owner replaced a crawler-tractor with a 186 hp rubber-tired electric-control Tournatractor.

This 19 mph unit proved so successful, it now works 3 eight-hour shifts daily, 5 days per week. Each day, it travels more than 100 miles around the pit to do its work — 40 to 45 miles on the day shift, 30 to 35 miles on each of the two night shifts.

All-purpose tool

Its major assignment on all shifts is to clean up for 2 shovels, located 1½ miles apart, and to maintain 2 overburden dumps. Traveling job-to-job at speeds to 19 mph, it usually makes 4 trips per shift to each of the shovels and 4 trips to each of the dumps. In addition to these 16 trips and 16 clean-up periods per shift, the versatile unit still finds time to do odd-lot tasks. Five or six times a day, it cleans up around the crusher. During travel between shovels and dumps, it helps a motor grader clean rock spillage from the haul roads.

Instant-shift, constant-mesh transmission enables this highly mobile unit to doze in and back away in a hurry, without delay to shovel. Torque converter eliminates jolting gear changes.

Despite its greater speed, men on the job report Tournatractor has been far less costly to maintain than track-type tractors. In 9 months of round-the-clock routine, the machine has been shut down only 3 times for minor repairs, not at all for major repairs. Its mechanical efficiency has been better than 95%.

"Tournatractor has done a good job — especially on shovel clean-up," says the assistant quarry superintendent. "Its mobility is very satisfactory."

"I like the rubber tires," adds the Tournatractor operator. "They get you to a job faster, and help you do the work faster. The fine seat makes work a lot easier, too."

If your work involves abrasive materials, or jobs scattered around a large area, it will pay you to investigate Tournatractor. Ask for a demonstration!

Tournatractor—Trademark T-620-Q-b

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

grind profitably with...

CF&I GRINDING RODS

Profits in mineral dressing are based on efficiency and long equipment life—the same reasons that are responsible for the wide acceptance of CF&I Grinding Rods. Rolled from special analysis steel, machine straightened with square-cut ends, CF&I Grinding Rods are a grinding medium of top performance and value—they wear evenly and resist abrasion.

Other CF&I Steel Products for the Mining Industry

Cal-Wic Industrial Screens • Wickwire Rope • Rock Bolts

Grinding Balls • Light Rails and Accessories

CF&I **GRINDING RODS**

THE COLORADO FUEL AND IRON CORPORATION

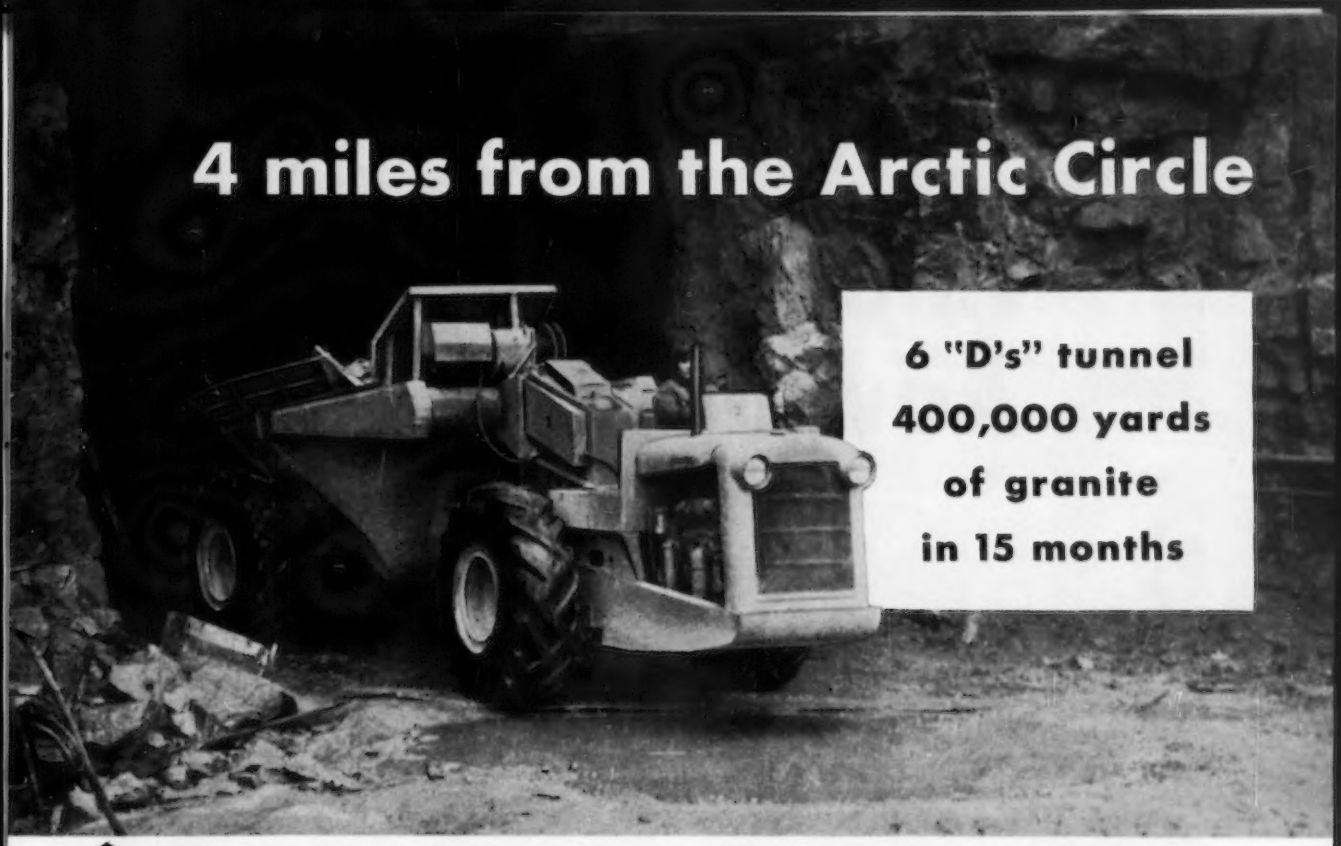
Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Denver • El Paso • Ft. Worth • Houston • Lincoln (Neb.) • Los Angeles
Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Wichita

2475

CANADIAN REPRESENTATIVE AT: Vancouver

A Subsidiary of Westinghouse Air Brake Company

4 miles from the Arctic Circle



6 "D's" tunnel 400,000 yards of granite in 15 months

Rear-Dump Tournapull emerges from one of the 4 tunnels where blasting operations are taking place. Tunnels will total 4.3 miles in length. All are 16 ft. high, and 20 ft. wide. "D's", with their 12'4" turning radius, are ideal for work in such confined spaces.

At site of dam where units worked occasionally, 1½-yd. shovel loads Rear-Dump with 8 cubic yards of blasted granite. Big, wide top opening allows load to be made in 2 to 2½ minutes with minimum spillage.

"D" dumps load of rough, blasted granite for fill. Front-wheel drive and big air-brakes let unit back, unload safely over edge.

At Jumisko, Finland, only 4 miles south of the Arctic Circle, Pohjolan Voima Co., a prominent Scandinavian firm, worked 24 hours a day, 7 days a week, on a rock-hauling job similar to that found in many mines and quarries.

Rock-moving was continuous even in winter when temperatures dropped to 40° below zero, and snow lay 5 feet deep around the tunnels.

Severe weather for men and machines did not stop the 6 Model D Rear-Dump Tournapulls which moved all 400,000 cubic yards of granite involved in the project — digging of 4 tailrace tunnels and building a system of dams for a hydro-electric power station. All through their grueling 24-hour-a-day schedule for over a year, machines worked with virtually no downtime. Company records show the 6 units maintained 95% mechanical efficiency despite adverse conditions.

Most of the time, material was blasted to form the tunnels, shovel-loaded into the Tournapulls and hauled up 1 to 12½% grades to the fills and dams. Haul was made partly through the tunnels with loads averaging 8 cubic yards of the high void material.

Good production brings repeat orders

Output and mechanical efficiency were considered so good the contractor has added steadily to his fleet of LeTourneau-Westinghouse machines. He bought his first two 9-ton "D" Rear-Dumps in May, 1955. Two additional units were purchased in July, 1952, and two in January, 1953. Now, Pohjolan Voima Co. has one more Tournapull Rear-Dump on order.

If you must work under some of the handicaps faced by this Finnish firm, you ought to check on Rear-Dump Tournapulls. Their short turning radius speeds work in tight quarters. Their simple rugged construction eliminates many repairs. They're easy to operate and run well in extreme cold, extreme heat, or high altitudes. There's a size to fit your needs . . . 9, 22 and 35 tons. Write or call us for all the details. There's no obligation.

Tournapull—Trademark Reg. U.S. Pat. Off. R-458-D-b

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Factory-Assembled Lineup Offers

5 Important Advantages

1. Centralized Control — All high voltage control for an entire department or plant may be concentrated in one place. When located in a separate control room, starter lineup operates in cleaner atmospheres. It also may be made inaccessible to unauthorized personnel.

2. Low-Cost Installation — Control group is factory-assembled *and bussed*. Conduit layout is greatly simplified. For example, lineup requires only one incoming power feeder.

3. Simplified Expansion — Internal bus and convenient wiring provision plus standardization of cubicle size facilitate addition of starters. Each starter unit is self-contained. Expanding the lineup is merely a matter of adding a starter and connecting the bus.

4. Attractive Appearance — Uniformity of cubicles presents a modern, streamlined appearance.

5. One-Company Responsibility Complete responsibility for assembling proper control devices and for control performance rests with Allis-Chalmers. A-4704

For complete information, see your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Tournapull's power-transfer differential, which automatically prevents wheel slippage, keeps rig moving through soggy footing where other units often bog down.

Speed your Mine exploration with a versatile D Tournapull

The HIGH-SPEED, self-loading D Tournapull has the versatility needed to speed all the exploratory phases of your mine development. This job-proved unit moves in or around any location at speeds up to 28 mph. It cuts grades accurately, hauls anywhere, and spreads in controlled layers. Its big tires effectively compact material. Where land restoration is required, the "D" is ideal for segregating topsoil, refilling and landscaping. Where ore-bearing soils are to be tested, the 138 hp "D" will self-load over 5 bank yards per trip for quick delivery to screens or hopper. Where dams or reservoirs are needed for water supply — ditches or sluiceways for drainage — the "D" moves in, gets the job done fast, and moves on to the next task without delay.

Big low-pressure tires, positive power steer and a unique power-transfer differential enable Tournapulls to travel slippery saddleback roads or through deep mud and sand which would stall an ordinary truck. Electric scraper and steer controls and a foam-rubber seat give easy operation and easy riding in tough going. These are but a few of the reasons why this fast utility tool speeds search and pilot tasks, cut costs, and eliminates many inconveniences of exploratory operation. It will pay you to learn more about what it can do for you.

Tournapull—Trademark Reg. U.S. Pat. Off. DP-58-M-b

LeTourneau-Westinghouse Company

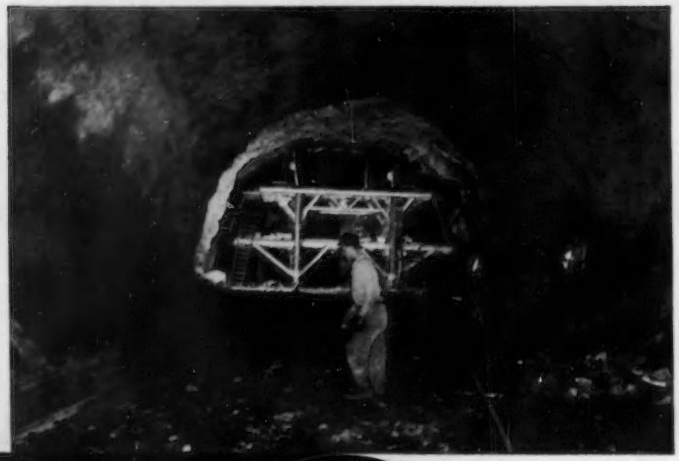
PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

The self-loading "D" handles all these jobs:

- Clears, levels sites for camps and drill setups. Eliminates cost of expensive cribbing.
- Strips surface material to expose bedrock. Gives you better access to formation.
- Builds, maintains and gravels access roads. Fills roads across soft, low areas.
- Loads, hauls material from open pits in 9-ton (7-yard) scraper.
- Hauls in supplies. Carries loads over terrain no other wheeled vehicle can cross.
- Levels building sites. Digs sludge basins, drainage ditches and sluiceways.
- Moves into any site under its own power — over pavement or cross-country.
- Supplies electricity for emergency lighting or temporary equipment operation.
- Plows snow from supply roads. Self-loads, hauls snow, ice from camp sites.
- Dozer blade available. One man can do clearing, build roads, drain, grade and strip.

Part way through the 705 foot rock section on the New Jersey side.



THEY'RE AVERAGING 630-FEET PER ROD

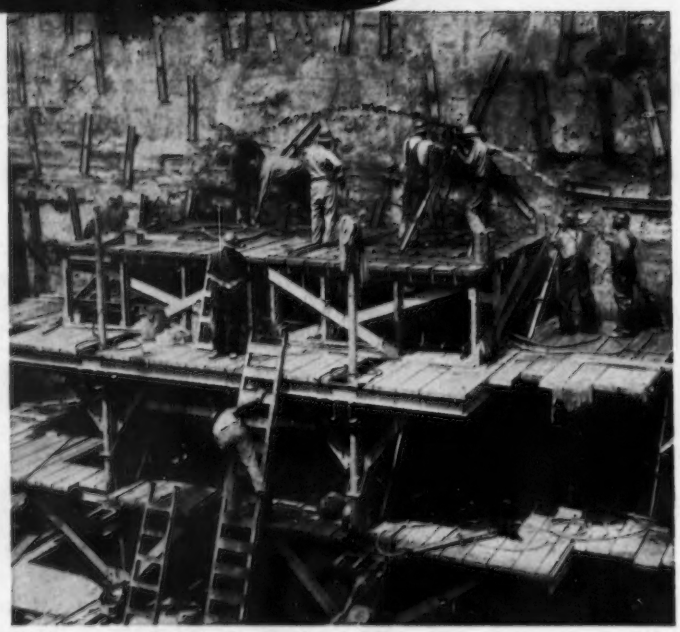
with

CRUCIBLE alloy hollow drill steel...

When completed the third tube of the Lincoln Tunnel will speed vehicular traffic between New York and New Jersey under the Hudson River.

On the New Jersey side construction involves tunneling through 705 feet of rock, and moving 24,000 cubic yards of trap-rock and sandstone. For this big job the contractors, Mason Johnson MacLean, chose Crucible CA Double Diamond alloy hollow drill rods. It proved to be an excellent choice, for in drilling 108,500 feet of hole, Crucible alloy drill rods gave an average of *630-feet per rod.*

There's good reason for this *extra* performance. For Crucible alloy hollow drill rods are made to *tool steel standards,* by the nation's leading producer of tool and other special purpose steels. You can count on longer rod life . . . fewer broken rods . . . *lowest cost per foot of hole drilled* . . . when you specify Crucible alloy hollow drill rods. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*



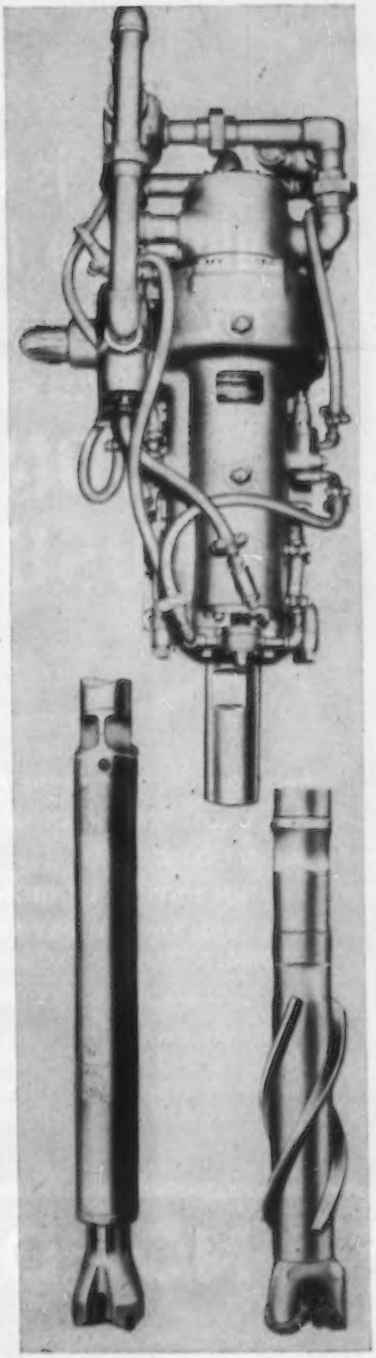
Drilling starts on the third tube of the Lincoln Tunnel.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

E&MJ NEW PRODUCTS DIGEST

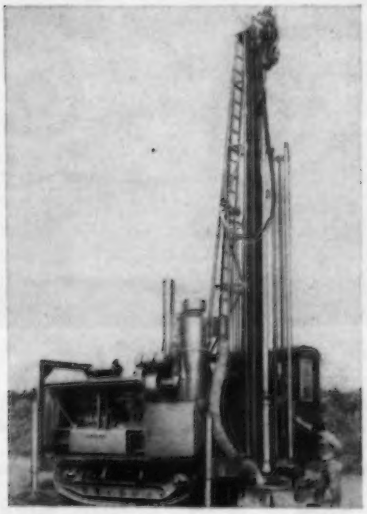
CUSTOM MOUNT for Ingersoll-Rand's air operated, self-contained "Drillmaster" is truck; crawlers are standard. Various components can be selected to fit rig to job.



Down-the-Hole Drill Bows In

Using the "down-the-hole" principle, so long a conversation piece among drillers, Ingersoll-Rand is now offering the "Depth-Master" drill for deep blast holes up to 6 in. in diameter.

The Depth-Master is actually only one combination of components developed by the company to provide a more flexible rig to meet varied conditions. The general name for this self-contained outfit is the "Drillmaster." There are two basic components: the assembly of compressor, dust collector, derrick and auxiliary equipment; and the "Roto-Master," a chain feed, rotary drill head (upper right), which rotates the hollow drill steel through which air is supplied.

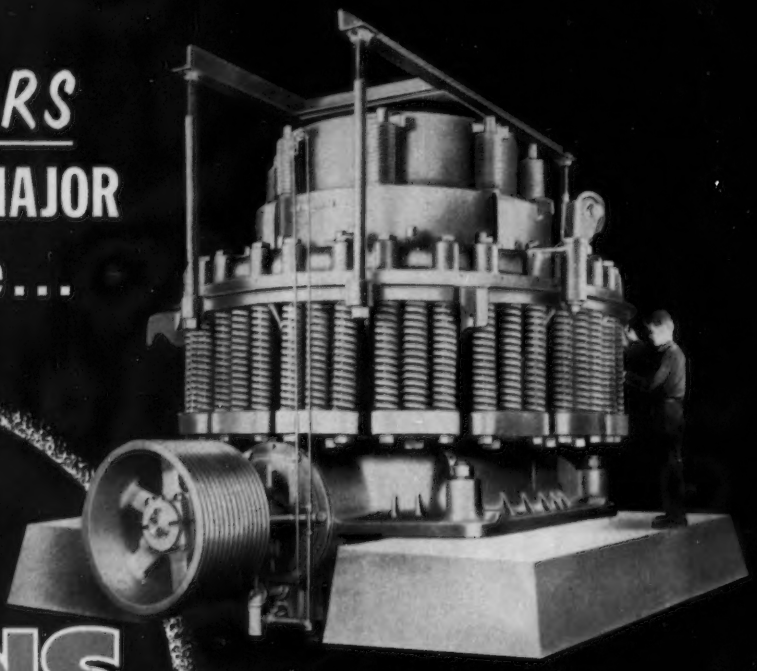


Unique component is the air operated percussion device (left of lower right photos) which is attached to the lower end of the drill stem and actuates the easily replaced Carset, tungsten carbide bit. All energy is thus used to break rock, not move drill stem. This assembly, the "Depth-Master," is claimed faster than a rotary, can more readily drill straight in fractured ground and can be used on hard rock. Using 6 in. bit, penetration rates of 10 to 12 ft per hr in traprock, 18 to 20 ft per hr in granite, and 50 ft per hr in Pennsylvania limestone, have been reported.

For softer rock and shallower holes, only the roller cone bit (lower right) is used in place of the Depth-Master. Both roller cone and Depth-Master combinations were designed for the usual open pit hole — under 125 ft — but no maximum depth has been specified. For holes 4 in. or less, up to 60 ft deep, there is an "out-of-the-hole," non-rotating, heavy duty hammer drill, the "Power-Master", which is attached below the rotary head.

REPEAT ORDERS

from the WORLD'S MAJOR PRODUCERS prove...



There is no substitute for SYMONS® CONE CRUSHERS

...here are a few good reasons:

- LOWEST COST PER TON OF CRUSHED PRODUCT
- UNIFORM CONTROLLED FEED
- MAXIMUM LINER UTILIZATION
- GREAT CAPACITY OF FINELY AND UNIFORMLY CRUSHED PRODUCT
- LOW COST—TROUBLE-FREE OPERATION

Symons Cone Crushers, *the machines that revolutionized crushing practice*, are built in Standard, Short Head and Intermediate types, with crushing heads from 22 inches to 7 feet in diameter—in capacities from 6 to 900 tons per hour.

Proved in the profitable reduction of these and many more ores and minerals . . .

- ASBESTOS
- ABRASIVES
- CEMENT
- CHROMIUM
- COPPER
- FELDSPAR
- GOLD
- GRAVEL
- IRON ORE
- LEAD
- LIMESTONE
- MANGANESE
- MOLYBDENUM
- NICKEL
- SILVER
- SLAG
- STONE
- TACONITE
- TITANIUM
- TIN
- TUNGSTEN
- URANIUM
- VANADIUM
- ZINC

SYMONS . . . A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
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C355

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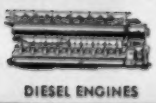
SYMONS PRIMARY GYRATORY CRUSHERS

GRINDING MILLS

MINE HOISTS

SYMONS VIBRATING GRIZZLIES and SCREENS



DIESEL ENGINES

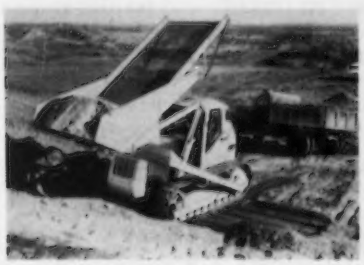
Two Super Tractors Make Debuts

Euclid's 58,000-lb "TC-12" is powered by twin diesels, each driving one track, joined by a single large transverse shaft allowing for disconnection in shipping and permitting some individual movement in operation. Allison Torqmatic drives allow changing speed range under power. Hydraulic jack tensions tracks automatically (*E&MJ*, Dec. 1954, p. 35) **(2)**

Caterpillar's 56,000-lb "D9" has turbocharged diesel, is rated as 230 drawbar hp machine. Field tested extensively during 1954, it features hydraulic track adjustment, operator visibility and servicing conveniences. Oil type clutch or torque converter is optional. Operator comfort and safety have been stressed by the manufacturer. **(3)**

TRACTOR-LOADER (4)

Outstanding feature of the two latest "Payloaders" is the 40 deg of bucket breakout at ground level rather than at 3- or 4-ft carry position, according to Frank G. Hough Co. The "HU", 1-yd, and "HH", 1½-yd, use ground pads to lift.



GRIZZLY LOADER (7)

With this attachment for the Austin overshot loader, loading and screening can be accomplished in one operation. Oversize is dumped on opposite side of truck. It is made in several sizes to handle up to 12 yd per minute by Central Ohio Steel Products Co., Galion, Ohio.

EMERGENCY MASK (5)

Available in two models, either air or O_2, Mine Safety Appliances Co.'s newly designed mask can provide 30 minutes of service. Weighing only 30 lb complete, it consists of face piece, demand valve assembly and cylinder. Fogging is prevented by inhalation flow across lenses. Speaking diaphragm permits talking.

SILICONE INSULATION (8)

Allis-Chalmers Mfg. Co. has announced the first all-silicone-rubber insulating system for large motors and generators. Known as the "Silco-Flex" system, it brings engineers closer to the goal of the "perfect" insulation that won't deteriorate or change with age.

EARTHMOVER (6)

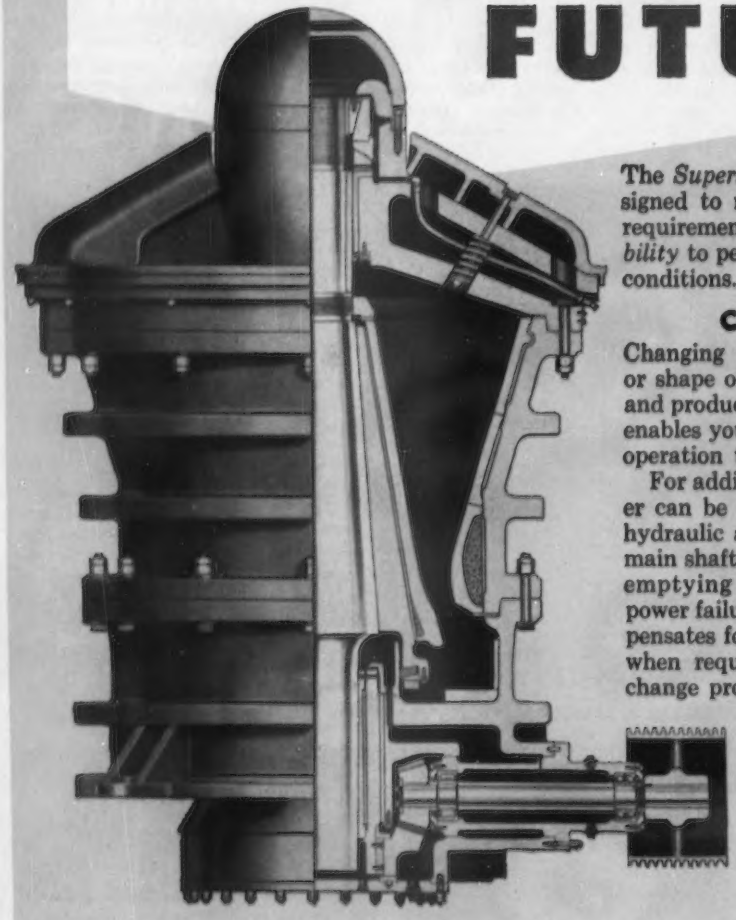
Largest high-speed, rubber-tired earthmover in the International Harvester line, the "Payscraper" is designed for big jobs. With a 262 hp diesel, it cuts through tough material, scoops up an 18-cu yd load, and highballs along at more than 24 mph.

TRAILER (9)

Powerized gooseneck eliminates skids and permits one man to handle equipment over the front end of the "LXC-33D" trailer. Of 33-ton capacity, it uses a hydraulic mechanism, and disconnects in 3 minutes. Made by LaCrosse Trailer Co., LaCrosse, Wis.

SUPERIOR
Primary & Secondary
CRUSHER

Meets your needs TODAY and in the FUTURE!



The *Superior* crusher you install today is designed to meet your specific and immediate requirements — and it also has *built-in flexibility* to permit adaptation to future operating conditions.

Complete Adaptability

Changing the eccentric throw, crusher speed or shape of crushing chamber, varies capacity and product size. This high degree of flexibility enables you to obtain the best possible crusher operation to suit other plant equipment.

For additional flexibility, the *Superior* crusher can be fitted with *Hydroset* mechanism, a hydraulic arrangement for raising or lowering main shaft and mantle. This control facilitates emptying the crushing chamber in case of power failure or other emergencies. It also compensates for wear on concave and mantle and, when required, makes it possible for you to change product size instantly.

Write for Bulletin 07B7870

This 32-page bulletin describes the *Superior* crusher and gives you valuable crushing data. It's a book you'll want to have and keep. Ask your A-C representative for a copy or write Allis-Chalmers, Milwaukee 1, Wis.

A-4635

Superior and *Hydroset* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

UNUSUAL WET SEPARATOR INVENTED

The Fanning Ore Concentrator was developed to treat mineral bearing sands but only a few of its potential applications have been tested, according to Carpco Engr. & Mfg., Jacksonville, Fla. A gravity type device, it handles pulp at 65% solids, has no moving parts and is rubber coated to counteract abrasion. The simple, light weight, troughlike apparatus is claimed to be highly efficient. Average performance indicates 5-10% heavy mineral ore can be treated in three stages to yield a 85-90% concentrate. Recoveries have consistently been as high as 95%, it is said. Feed rate is about 3 ton per hour on a standard double unit. Reported to be inexpensive, it makes a very compact setup. **(10)**

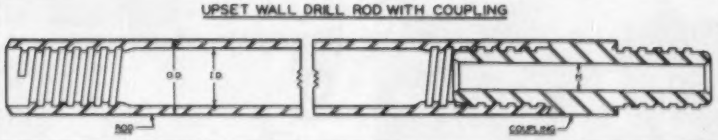
CONDUIT (11)

Tough, durable finish of polyvinylchloride makes General Electric Co.'s coated conduit and tubing especially recommended for use in unusual atmospheric conditions.

WORKSHOE (12)

Permanent water repellency without stopping "breathing" is claimed for silicone tanned leather field boots from Red Wing Shoe Co., Red Wing, Minn. Heat won't shrink or harden them.

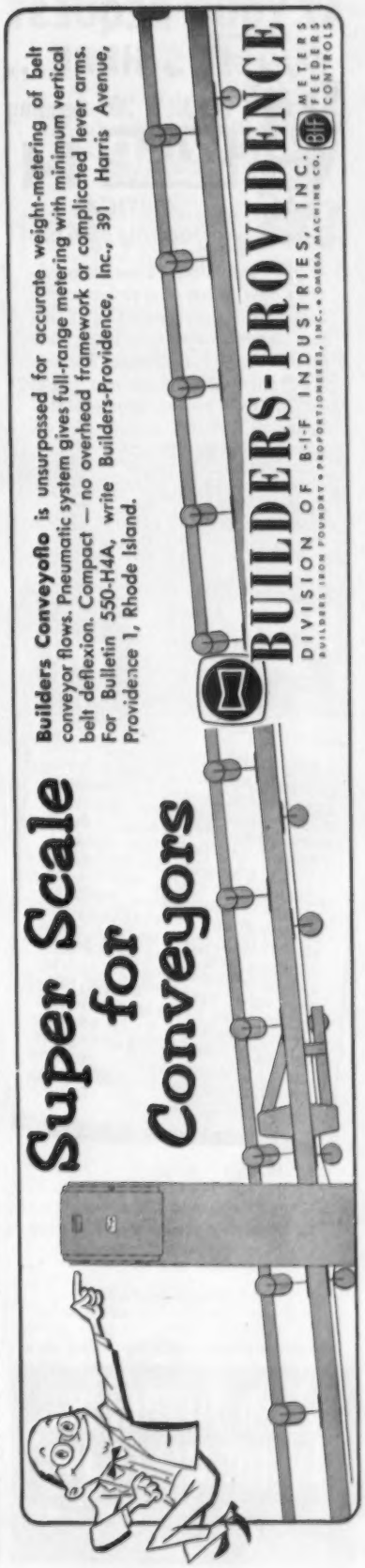
UPSET WALL DRILL ROD WITH COUPLING



Size of Rod and Coupling		EW	AW	BW	NW
Specifications	O.D. of Rod & Cplg.	1-3/8"	1-3/4"	2-1/8"	2-5/8"
	I.D. of Rod	1-1/16"	1-7/16"	1-13/16"	2-5/16"
	H Hole in Coupling	7/16"	5/8"	3/4"	1-3/8"
	Threads per inch	3	3	3	3
	Approx. wt. of 10' rod w/coupling	25.0 lbs.	33.6 lbs.	43.1 lbs.	55.3 lbs.

NEW STANDARD DRILL RODS (13)

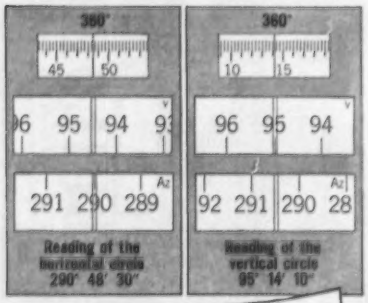
E. J. Longyear Co. recently announced a complete line of drill rods developed to the new standards adopted by the Diamond Core Drill Manufacturers Association and the Canadian Diamond Drilling Association. Known as the "W" series, these rods come in EW, AW, BW and NW sizes. The standards are recommended for world-wide acceptance, the over-all increase in size makes for a more stabilized drill string with less vibration and a minimum of ground caving. The increased inner diameter of the rod provides a larger water passage through the drill string and reduces pressure loss. The increased outer diameter reduces the area between the drill string and the hole wall, giving quicker return of sludge.


Super Scale for Conveyors
Builders Conveyoflo is unsurpassed for accurate weight-metering of belt conveyor flows. Pneumatic system gives full-range metering with minimum vertical belt deflexion. Compact — no overhead framework or complicated lever arms. For Bulletin 550-H4A, write Builders-Providence, Inc., 391 Harris Avenue, Providence 1, Rhode Island.
BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS
FEEDERS
CONTROLS

AT YOUR REQUEST IT'S HERE...

The NEW 20" Reading WILD HEERBRUGG® T-1 OPTICAL *Repeating* TRANSIT

In answer to many requests, available now as an alternative to the Standard Model (reading direct to 1', interpolation to 6"). The New Model WILD T-1 Optical Repeating Transit gives direct reading to 20" on both circles, easy interpolation to 10" (as shown below).



The WILD T-1, with years of proven service under all field conditions, is the most widely used modern transit because it offers you: - full behind-instrument operation, a built-in optical plummet for fast set-up, an optical micrometer reading system which eliminates possibility of error. It sets on zero and repeats angles. Illumination is provided by daylight mirror or battery attachment for night, tunnel or mine work. Made by the world's largest surveying instrument manufacturers and backed by full factory service here.

T-1 TRANSIT $740
Reading direct to 20 seconds, interpolation to 10 seconds.

T-1 TRANSIT (Standard Model) $722
Reading direct to 1 minute, interpolation to 6 seconds.

(All Model Tripods Extra)
PRICES F.O.B. PORT WASHINGTON, N. Y.

For details phone or write for Booklet MJ 6

WILD HEERBRUGG INSTRUMENTS INC.
MAIN & COVERT STS., PORT WASHINGTON, N. Y.
PORt Washington 7-4843

E&MJ NEW PRODUCTS DIGEST

POWER HACKSAW (14)

"Porta-Band," Model 524, is said to be the first really portable powered metal-cutting saw. Electric driven, lightweight —16 lb—small and well balanced, it can be used free-hand in any position. Blades are easily changed. It can cut stock 3½x4¼-in. in size, is made by Porter Cable Machine Co., Syracuse, New York.

VIBRATOR (15)

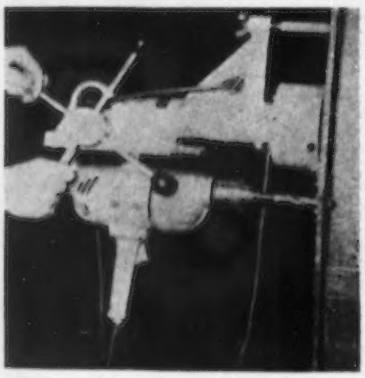
Quiet in operation and weighing only 98 lb, the RC-30-LSRR electric vibrator speeds the unloading of covered hopper railroad cars. Made by Cleveland Vibrator Co., it is in a totally enclosed housing, sealed from moisture and dust. The device employs the rotary weighted shaft principle working at 60 cycles per minute.

FIRE EXTINGUISHER (16)

First Underwriter's approved pressurized water-type fire extinguisher "ELK-AIR," has been announced by Elkhart Brass Mfg. Co., Elkhart, Ind. Using only air pressure rather than a cartridge charge, recharging is done merely by replacing the water and pressurizing by air the same as an auto tire. It eliminates annual inspection and chemical damage.

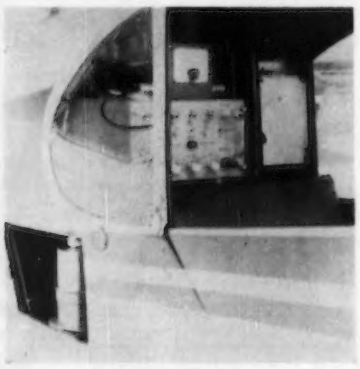
TRUCK PUMP (17)

Latest truck-powered tool by H. S. Watson Co., Emeryville, Calif., is a tiny rotary pump. Spraying and fire-fighting uses are already established, others are constantly being reported. Developing up to 350 psi, the device taps the engine power of light-trucks and pickups through the company's recently-introduced handy rear power source.



DRILL PRESS (18)

Electro-magnet holds "Bux" in any position right on work. It has a 12 in. stroke, can handle electric or air drills up to 1½ in. size, weighs only 46 lb plus drill. Made by Buck Mfg. Co., Los Gatos, Calif.



SCINTILLOMETER SET (19)

Aerial work is aided by 75-lb "DS-7" outfit from Nuclear Instrument and Chemical Co., Chicago, Ill. Detector, rate meter, recorder and dynamotor are included as well as an audible alarm.

METAL DETECTOR (20)

A low cost device said to be sensitive to all magnetic and some non-magnetic metals was announced by Dings Electronics Co. Consisting of a rectangular search coil for placing around a conveyor belt and a small control cabinet that plugs in any single phase outlet, it requires no attention, and can be set to overlook lacing.

RAIL CUTTER (21)

Using a resinoid bond cutting wheel ¼ to ⅜ in. thick and 30 in. in diameter, the U. S. Corps of Engineers have developed an electric driven device that dry cuts 152-lb rails in 45 seconds. Made by Ty-Sa-Man Machine Co., Knoxville, Tenn., the cutter uses a wheel especially designed by Raybestos-Manhattan Co. It is said to give a clean burn free cut.

The Engineer's Report

CASE HISTORY

PRODUCT *RPM Delo Oils*

FIRM *Bagdad Copper Corp., Bagdad, Arizona*

Biggest truck in the world uses RPM DELO Oil!

246,000 POUNDS TOTAL LOAD, 48 tons of truck and 75 tons load, are hauled out of the Bagdad Copper Corp.'s ore pit at Bagdad, Arizona, by the two 350 h.p. supercharged diesels in this unit. RPM DELO Special Lubricating Oil is used in the engines as specified by Mr. Ernest Dickie, General Manager of Bagdad, on the basis of his years of experience with RPM DELO Oils in many other heavy-duty engines.

The big truck, described as the largest in the world, was designed by Mr. Dickie and engineers of Dart Truck Co., builders. Power is transmitted through 3-stage torque converters. All controls are powered.

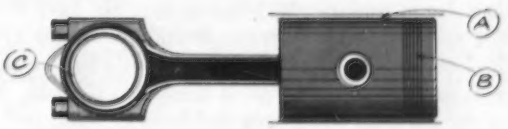
FREE FOLDER tells you about all the RPM DELO Oils and how they meet every heavy-duty engine condition. Write or call for it today.

FOR MORE INFORMATION about petroleum products of any kind or the name of your nearest distributor, write or call any of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U. S. PAT. OFF.

How RPM DELO Oils reduce wear, corrosion, oxidation in all heavy-duty engines



A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

To do a big job fast, they called on the DW21s

When the picture was taken, this Caterpillar DW21 had been working 20 hours a day, six days a week for six consecutive weeks. It and five other DW21s had to move *four million tons of overburden in two months* from a copper pit at Kimberly, Nevada. Much of the material was frozen and hard to work, and some grades were 10% adverse. The DW21s and No. 21 Scrapers, together with three Caterpillar track-type Tractors and a No. 12 Motor Grader on the job, are owned by Young and Smith Construction Co. of Salt Lake City.

What's back of choosing DW21s for a big job like this? First of all, according to Elmo Longstroth, superintendent for Young and Smith, there's the ability of the DW21 to stand up to rough usage. It's designed as a unit, and matched to scraper capacity, for long life and top efficiency.

Heart of the DW21 is its big CAT* Diesel Engine, with 275 HP (A.S.M.E.).

The DW21 is easy and fast to handle. With the No. 21 Scraper, it can turn in a 35-ft. roadway. The load is taken on quickly, with a live, boiling action, and ejected smoothly and positively. Conveniently grouped controls, hydraulic steering, good visibility — such features as these keep operators fresh and at peak efficiency.

Your Caterpillar Dealer will give you performance figures on the high-profit DW21. See him today — and count on him for prompt, dependable on-the-job service and genuine Caterpillar parts.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

ENGINEERING IRONS. Through an error in March, International Nickel Co.'s very fine, 26-page bulletin on engineering irons was designated as Bulletin A-60. The designation should have read "Bulletin A-69." If by chance you received the wrong publication, please circle No. 50 on the NPD reply card in this issue and you will receive the correct bulletin on engineering irons. **(50)**

LUBRICATION WALL CHART, containing recommendations for air compressors, electric motors, hydraulic systems, et al, is available from E. F. Houghton & Co., Philadelphia, Pa. **(51)**

PREVENTIVE MAINTENANCE CHART for all conventional five-speed truck transmissions, from Fuller Mfg. Co., Kalamazoo, Mich., is designed to help operators, mechanics and owners. It covers every check point. **(52)**

DIESEL AND GAS ENGINES made by Nordberg Mfg. Co., are called Power Chiefs, and are described in a 12-page bulletin. The diesels are one, two and three cylinders, 10 to 45 hp. The gas engines are one and two cylinders, 18 and 36 hp. **(53)**

ROLL AND VANE-TYPE FEEDERS are specified in a bulletin from Fuller Co., Catasauqua, Pa. The longitudinally grooved roll gives a uniformly steady stream. The vane type gives less accurate volume discharge. Both are for dry, pulverized or granular materials. **(54)**

WELDING ROD SELECTION is told by Eutectic Welding Alloys Corp., Flushing, N. Y., in their 16-page "Rod Finder Guide." It covers recommendations on rod, flux and electrode for torch and metal arc joining and overlaying of all base metals. Many specific alloy "tips" are made for special applications. **(55)**

ALUMINUM ELECTRICAL CONDUCTORS are treated in two publications by Reynolds Metals Co., Louisville, Ky. The first discusses joining and points out that a pound of the light metal is equal to two of copper, electrically. The second is a guide to selection of accessories. Circle respectively **(56)** and **(57)**

CORROSION RESISTANT PUMPS & VALVES are specialty of the Duriron Co. Inc., Dayton, Ohio. Several bulletins are available describing the many fabrications using a wide variety of alloys. **(58)**

AFTERCOOLERS AND SEPARATORS for compressed air systems is the topic of a brochure published by R. P. Adams Co., Buffalo, N. Y. Included is a check sheet to help determine the effectiveness of your present cooler. It is written to help cut the hidden costs. **(59)**

AIR IMPACTOOLS is the title of Ingersoll-Rand's 52-page catalog on what they claim is the answer to reducing fastening costs. On-the-job photos and case histories are presented, as are accessories. **(60)**

WASHER-CLASSIFIERS made by Eagle Iron Works, Des Moines, Iowa, use the screw type mechanism and log-washers. They are comprehensively covered in a 44-page catalog that gives photos of applications, capacity tables and a host of other specifications to aid selection. **(61)**

STRAINERS, to remove fine suspended particles from raw or process water, oil and many other liquids, seem to be little publicized today. S. P. Kinney Engrs. Inc., Carnegie, Pa., include a very impressive list of customers for their several types in a recent brochure. It covers specifications on strainers, including automatic ones, for pipelines 2 to 48 in. **(62)**

BULK CONVEYOR catalog from Jervis B. Webb Co., Detroit, Mich., describes their trough belt and log types. The latter uses one or more strands of chain, to which are attached cross bars, operating in a trough. Other types are briefly mentioned. **(63)**

FLOCCULANT, called Aerofloc, is discussed in a paper from American Cyanamid Co., Mineral Dressing Dept., N. Y., N. Y. The several reagents available consist of large complex molecules which, when added to aqueous suspensions, tend to bond together individual fine solid particles into flocs. Settling or filtration is speeded by this action. **(64)**

STEEL FLOOR GRATING specifications are given in a 16-page manual offered by Klemp Metal Grating Corp., Chicago, Ill. The company prepared it not as just a generalized sales-type of brochure but as a technical book. It contains safe load tables, size specifications and accessory equipment. **(65)**

COMPRESSED AIR SYSTEM ACCESSORIES and a concise, meaty discussion on the system in general are presented in a handbook provocatively entitled "Is Your Air Compressor Capacity Effective?" It is offered by Sarco Co. Inc., New York, N. Y. **(66)**

FLAW LOCATION BY DYE PENETRANTS is a 12-page booklet which describes in detail the Turco Dy-Chek inspection method. Briefly, a dye is applied to a surface to be tested, excess is wiped off, and a developer applied. Flaw location shows in red. Obtainable from Turco Products Inc., Los Angeles, Calif. **(67)**

TEMPERATURE CONTROL SYSTEMS are explained in a publication from Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill. It is a

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brief education in automation as well since it describes controls in general, to some extent, in the 8 pages. (68)

CAPACITROLS are basically galvanometers which are frequently the heart of automatic controls. Wheelco Instruments, Rockford, Ill., has a new line of these indicating controllers called the "400" series. Construction and applications are given in their Educational Bulletin. (69)

WIRE ROPE users will find Bethlehem Steel Co.'s new booklet "Handling and Care of Wire Rope" an item for their library. In addition to being a very readable publication, the illustrations are worth noting. The section on splicing presents drawings for making the necessary tools. (70)

UNDERGROUND MINING applications of Caterpillar Tractor Co's equipment is shown in a pocket-sized booklet entitled "Four Steps to Increased Profits In Underground Mining." Not a comprehensive text, it just gives some actual examples that paid off. (71)

SAFETY SIGNS that are self-sticking can be obtained from W. H. Brady Co., Milwaukee, Wis. They include basic purpose signs (e.g. "Danger") and specific purpose signs (e.g. "No Smoking") of various sizes. Used separately or in combination they conform to A.S.A. standards. Stock list is available on the low cost, impregnated cloth product. (72)

WOOD ROOF TRUSS selection has been simplified in a new publication according to Timber Engineering Co., Washington, D. C. Major types and their particular uses are illustrated. Primarily prepared as a guide for designers and contractors, the 16-page booklet points out the advantages and economies of timber as a structural member. (73)

CALKING STRIPS for corrugated covering are pre-molded of either rubber or asphalt compounds by Fabricated Products Co., West Newton, Pa. Called "Fabco Closures" they are reputedly far less costly than hand calking. (74)

INDUSTRIAL TELEVISION equipment manufactured by Radio Corporation of America, Camden, N. J., is described in a 4-page folder. Compact camera is a little larger than a small movie camera. Monitor is likewise small. (75)

HARD-SURFACING "why" and "how" is told in 8-page Ranite catalog. Welding people, as well as others, will find it rather complete and "to the point." (76)

WELDING SUPPLIES AND ACCESSORIES, both arc and oxy-acetylene, are cataloged in Air Reduction Sales Co., N. Y., N. Y., new 36-page publication. Their complete line is included—rods, fluxes, helmets, hose, trucks, alloys and more. (77)

MULTIPLE V BELT DRIVE using a single molded belt is believed to be a major advance in power transmission by the Browning Mfg. Co., Maysville, Ky. Using a narrow, multi-grooved sheave and a matched belt that is flat on top and grooved on bottom, the "Poly-V" drive requires shorter centers and has a higher capacity than the usual belt drive. The 36-page catalog gives engineering specifications. (78)

DUST COLLECTOR DESIGN of "Amerclone" by American Air Filter Co. Inc., Louisville, Ky., is detailed in a 4-page brochure. A compact unit, it uses a bank of new type cones or tubes as a primary centrifugal collector which bleeds off 10% of the primary air along with the dust. A hopper and another set of tubes further concentrates the dust. (79)

VIBRATING SCREEN line of Link-Belt Co., Chicago, Ill., is described in a new catalog. Capacity chart and other engineering data aid selection of the "CA" type which is for medium and heavy duty. (80)

SAND FILTER-CLARIFIER bulletin is available from Hardinge Co. Inc., York, Pa. It covers operating principles and gives performance data. Used to produce a crystal clear filtrate, the mechanism consists essentially of a spiral rotating scraper suspended at the center of a cylindrical tank. The scraper cuts a thin layer from the surface of the sand bed when the filter rate decreases. (81)

REFRACTORY AIR-EMPLACEMENT is outlined in a booklet by Basic Refractories Inc., Cleveland, Ohio. Printed in color, the publication discusses the history, development and current procedures in gunning practices. (82)

WATER SOFTENERS using zeolites are rather thoroughly explained by Permutit Co., New York, N. Y., in their revised bulletin. Specifications, operating characteristics and typical installation photographs are included. (83)

FLUOSOLIDS SYSTEMS can be used for drying, sizing or heat treatment. In Dorr-Oliver's folder the treatment is presented for all to understand. It covers the theory, operation, advantages and typical installations. Widespread industries are using the process. (84)

STRING DISCHARGE FILTERS may be useful in special circumstances. Technical details of the rotary vacuum filters so equipped by Filtration Engineers Inc., Newark, N. J., are told in a recent bulletin. Other types of filters are also mentioned. (85)

WROUGHT IRON PIPE CATALOG is a 52-page manual containing the most frequently required information on the subject. Published by A. M. Byers Co., Pittsburgh, Pa., it contains a wealth of data—many charts, tables and articles. (86)

MAGNETIC DRIVE called the "Dynaspeed" is a liquid cooled, eddy current coupling with no rotating electrical components. It is adaptable to most adjustable speed requirements. Made by Eaton Mfg. Co., Kenosha, Wis., it is described in bulletin SF-1 recently released. (87)

INDUCTION HEATING EQUIPMENT can be used for forging, hardening, annealing and metal joining. Westinghouse gives a review of practice and equipment in a 12-page booklet. (88)

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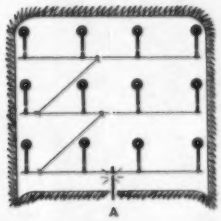
ON ITS WAY-
while you're away!

The holes are loaded and you're going to fire them in rotation — with IGNITACORD. Here's what you do:

1. Cut all safety fuse to the *same* length.
2. Crimp an Ignitacord Connector onto the exposed end of each fuse.
3. Hook up these connectors with Ignitacord so that each hole will "go" in its proper rotation.
4. Light the end of the Ignitacord and walk to a place of safety.

FIRING STOPE ROUNDS

Fig. 1 shows a stope drilled with three rows of uppers, the fuse from each hole being connected to a single line of Ignitacord. Note that the center holes will fire before the two corresponding rib holes.



In *Fig. 2* the fuses extending from the horizontal breast holes are connected to four lines of Ignitacord at regularly spaced intervals. Jumper lines connect the horizontal lines, and the igniter cord is activated by a length of Safety Fuse at Point A.

FIRING DEVELOPMENT ROUNDS

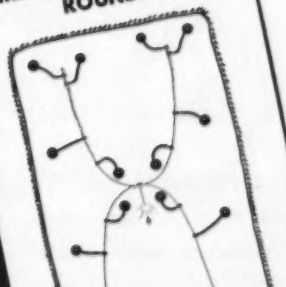


Fig. 3 illustrates an Ignitacord hook-up arranged to fire the cut holes in one group, and the remaining holes in the proper order of rotation. Ignitacord lines should always be kept separated enough to avoid cross ignition.

IGNITACORD* acts like a continuous Hot Wire Lighter. It's a flexible cord you can light with a match. It burns progressively with a short hot external flame at the zone of burning. Type A burns at approximately 8 to 10 seconds per foot — Type B at 16 to 20 seconds per foot.

Each type is packed on 100-foot spools with identifying label. Both types are color marked at one-foot intervals, making it easy to figure your timing.

Ignitacord CONNECTOR is a metal shell containing an ignition charge. It is crimped onto the end of the safety fuse, and the Ignitacord is connected to it as shown below. Connectors are supplied in packages of 100.

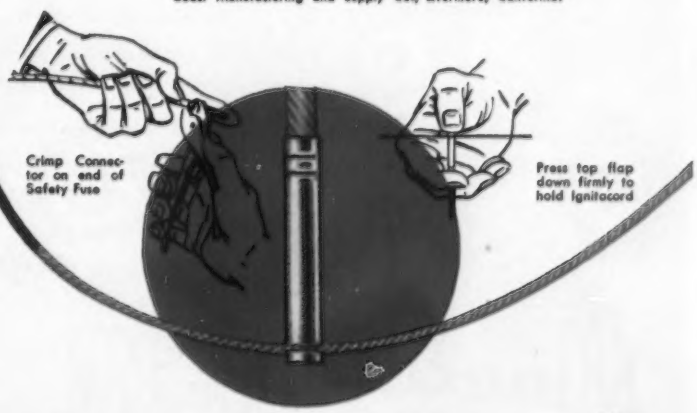
See your Explosives Supplier, or write to

THE ENSIGN-BICKFORD COMPANY

SIMSBURY, CONNECTICUT — Estab. 1836

Also Primacord® Detonating Fuse, Quarrycord, Safety Fuse, Blasting Accessories.

**Sold on the West Coast under the name of SPITTERCORD by the Coast Manufacturing and Supply Co., Livermore, California.*



IGNITACORD® and CONNECTORS

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IG-3

at O'Okiep Copper, too...
it's MARCY MILLS

Like so many other successful mining companies the O'Okiep Copper Co., Ltd. selected Marcy* Mills for low-cost-per-ton output and efficient, dependable mechanical operation.

● O'Okiep Copper Co., Ltd., exterior and the grinding section which includes 4—8' x 8' Marcy Grate Discharge Ball Mills and 2—4' x 8' Marcy Open End Rod Mills.

Why the Marcy principle of grinding...

"rapid change of mill content is necessary for high efficiency"...

gives greater output with lower KWH per ton

The "rapid change of mill content" is accomplished by use of the Marcy full grate discharge on ball mills and the open end feature on Marcy rod mills. This results in a low pulp line which provides an active, effective grinding mass to act on particle size reduction only... there is no wasteful cushioning action by high pulp levels. There is a faster migration of fines than oversize particles, thus less overgrinding.

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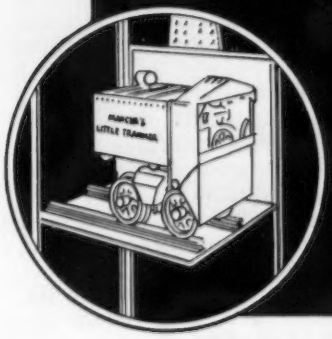

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For haulage duty . . . for moving mucking machines and drill jumbos . . . timber and supplies . . . or man trips to distant workings, Mancha's Little Trammer is the choice of mine operators everywhere.

If you'd see one of these powerful little locomotives in action, you'd see why. It's rugged and safe. It's small enough for work in narrow, crooked drifts, and easily transported from level to level. Climate, altitude and poor ventilation cannot slow it down. Maintenance cost is surprisingly low. Quite likely a Mancha's Little Trammer will more than pay its own way in your mine operations. Write for our mine haulage Data-Form and find out. There's no obligation on your part.

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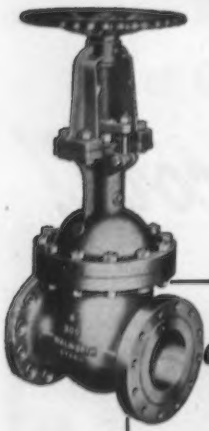

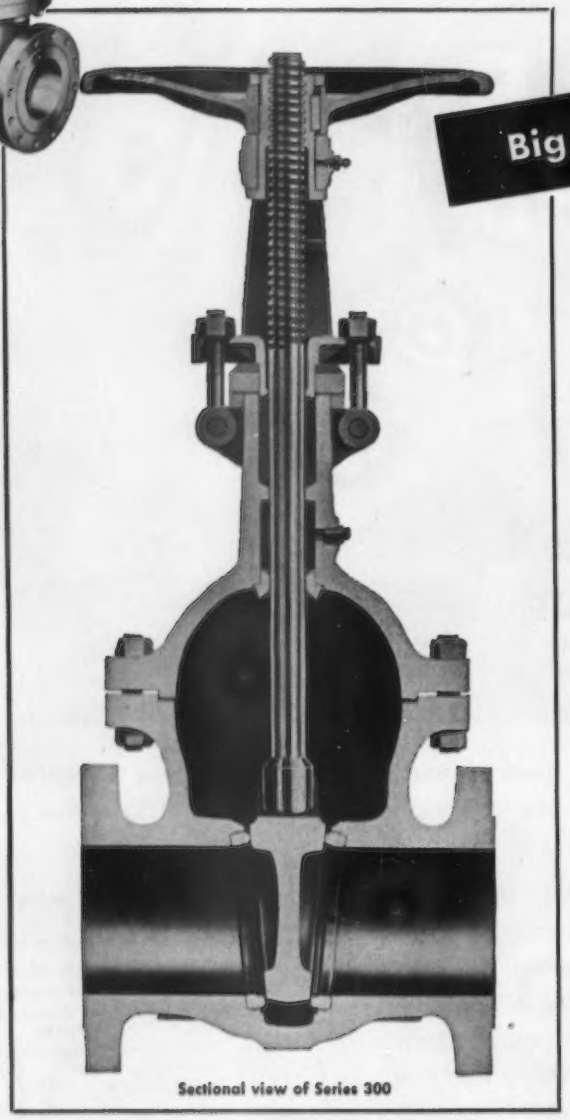

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Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2″ to 24″) insure tightness and maximum packing life – costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion – they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated – not flange type. No recess exists at back of ring – hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

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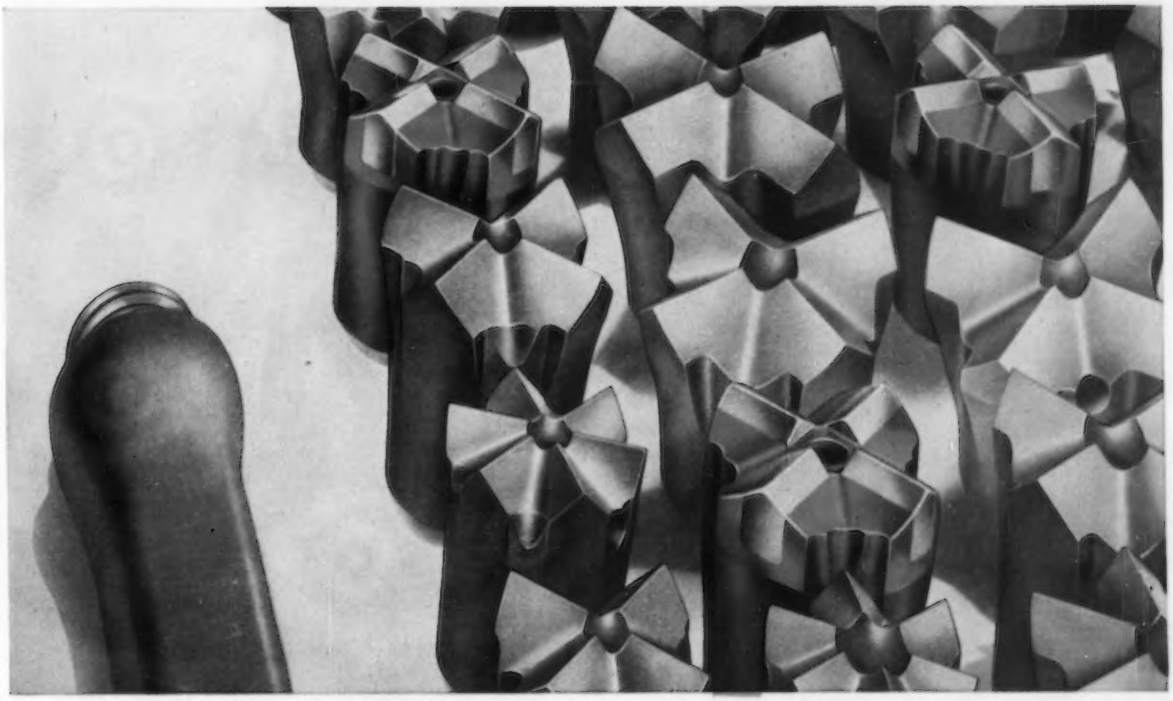

TIMKEN® interchangeable rock bits let you switch bit types... easily, quickly... without switching drill steels

YOUR drillers will save valuable drilling time with Timken® interchangeable rock bits. Both types, multi-use and carbide insert, fit the same steel, can be changed fast right on the job. Simply screw one type off, screw another right on the same steel.

This means new drilling economy—new savings in time, new boosts in production. Drillers can quickly switch to the most effective bit as the ground changes, instead of going after a different type of drill steel every time a different bit type is needed. What's more, because dozens of different Timken multi-use and carbide insert bits fit the same steel, you save on drill steel inventory.

Timken carbide insert and multi-use bits are both made from electric furnace Timken fine alloy steel. And both have the shoulder union, originated by the Timken Company, that keeps drilling impact from damaging threads.

Our rock bit engineers, backed by more than twenty years' drilling experience, can help you save money. No obligation, naturally. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant gauge holes, small-diameter holes, very deep holes.

... your best bet for the best bit... for every job

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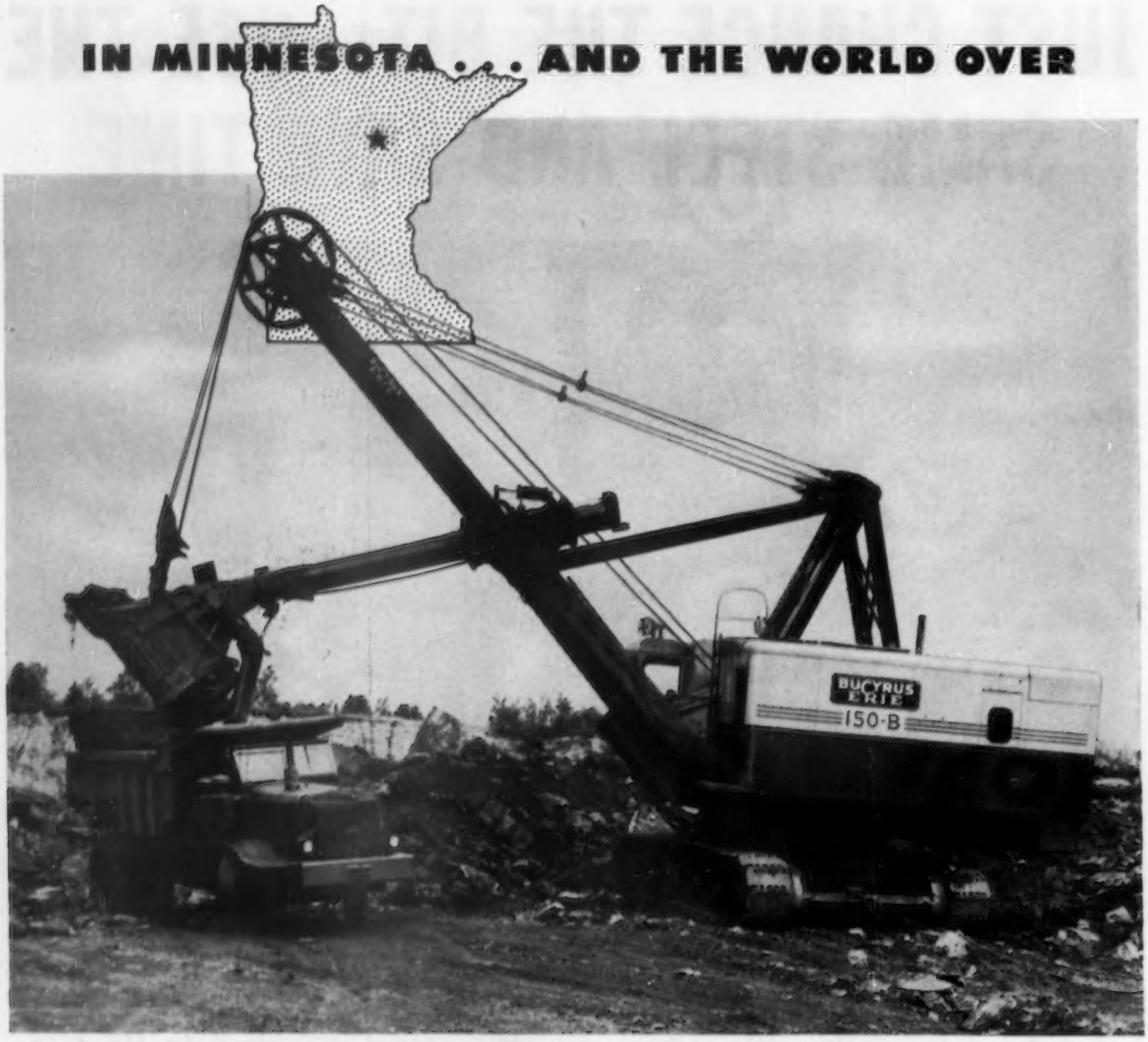
IN MINNESOTA . . . AND THE WORLD OVER



Rock meets its master

WITH A BUCYRUS-ERIE SHOVEL ON THE JOB

On the Mesabi Range, this 150-B shovel is loading out rocky overburden, delivering outstanding output. This performance story is being repeated daily in mines, quarries and on heavy-duty construction projects throughout the world.

New front-end design, extra-strong construction, and advanced engineering of Bucyrus-Erie Ward Leonard electric excavators give owners *that extra margin* of output that pays off in profits. 27154

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South Milwaukee, Wisconsin

Now—a roof support that gives instead of collapsing

Here is a truly major development in mine-roof control — a real step upward in safety and downward in maintenance costs. It's the Bethlehem Yieldable Arch, so called because its design permits the arch to yield, rather than bend or buckle, under excessive underground pressures.

The Yieldable Arch is made up of U-shaped segments heavily flanged to resist collapse and torsional stresses. Segments are joined by means of U-bolt clamps, creating friction joints which slide or yield under heavy pressures.

The yielding of the roof support permits the natural relaxation and stabilization of the surrounding strata. At the same time, the increased overlapping of the segments strengthens the arch and adds to safety in the mine.

Individual arches are tied together by horizontal struts which are clamped to the arch with special J-bolts. The struts help the arches to reinforce each other, and transmit lateral forces from one arch to the other. Bethlehem can also furnish steel lagging with the arches, if desired.

The Yieldable Arch is quick and easy to install, promises a very long life and high recovery value. It should pay for itself in its first year. A Bethlehem engineer is ready to discuss the full story with you. It's worth hearing. Just get in touch with the nearest Bethlehem office.

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BETHLEHEM YIELDABLE MINE ARCH

LOAD..MOVE..and FILL at LOWER COST

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FIRESTONE Nylon Off-The-Highway Tires are built to move more loads at lower cost. For any tough operation . . . earth moving, strip mining or rock work, Firestone has a nylon tire that will cut downtime and maintenance costs and keep men and equipment on the job.

It costs you less to run on Firestone Nylon Tires because the treads give maximum traction and they are extra tough to resist cutting. The sidewalls are double thick to give added protection against cuts and snags. The new Firestone Safety-Tensioned Gum-Dipped* nylon cord body gives the greatest protection against impact breaks . . . flex breaks . . . heat failures . . . and water damage.

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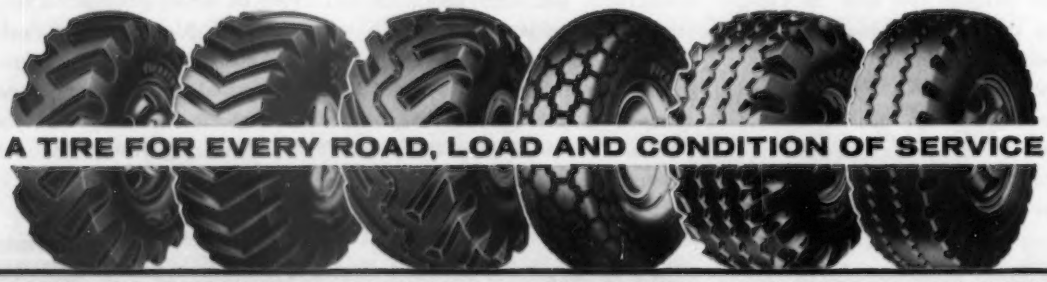

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Cyanamid REAGENT NEWS

"ore-dressing ideas you can use"

Frother problem?

One of these Five Cyanamid AEROFROTH® *Frothers may be the answer.*

Cyanamid now offers four higher-alcohol frothers and a water-soluble frother as well as pine oil and cresylic acid. All are liquids which may be used alone or in conjunction with other frothers.

AEROFROTH 63 Frother, a higher alcohol type, has found wide acceptance for coal flotation. It has a controlled frothing action which has proven highly advantageous for easy-to-float minerals such as coal, graphite, sulfur, molydbenite and talc. Produces a more brittle, less persistent froth than pine oil or cresylic acid.

AEROFROTH 65 Frother, a recent addition to the family, is a synthetic, water-soluble frother which produces a closely-knit, selective froth. Mill results have indicated that frother consumption can be reduced to one-tenth to one-third of previous consumption when the switch to AEROFROTH 65 has been made. Produces a less brittle froth than the other AEROFROTH Frothers.

AEROFROTH 70 Frother is a branch-chain alcohol producing a more selective and less persistent froth than pine oil or cresylic acid. Widely used in both metallic and non-metallic flotation operations.

AEROFROTH 77 Frother is a straight-chain higher alcohol, which has been substituted for pine oil or cresylic acid at many operations, resulting in increased selectivity and reduced frother consumption. Produces a slightly more persistent froth than AEROFROTH 70.

AEROFROTH 80 Frother is the latest addition to our family. A straight-chain, non-promoting alcohol frother, it produces a light-textured froth with high selectivity.

Cyanamid Field Engineers will be glad to work with you in your mill to select the frother or frother combination that will give you the highest recovery at lowest cost. With a wide variety of frothers available our recommendations will, of course, be unbiased. Your inquiry to our nearest office will receive prompt attention.

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MINERAL DRESSING DEPARTMENT

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AN IMPORTANT MESSAGE CONCERNING...

A Basic Advance In Motor Insulation

ELECTRIC motor and generator insulation has come in for its share of announcements of "new" and "revolutionary" developments. But in spite of these announcements, inherent shortcomings of conventional insulation have remained.

There has been little basic improvement in motor insulating systems . . . UNTIL NOW.

Allis-Chalmers, working with engineers and scientists of Dow Corning Corporation, has developed *Silco-Flex* motor insulation . . . truly new in concept . . . truly new in effectiveness.

The *Silco-Flex* insulation system employs a pure silicone rubber combined with specially developed application techniques to produce an insulation unmatched by any other in use today. Outstanding improvements are shown in all these important characteristics:

Homogeneity — The complete *Silco-Flex* coil insulation is vulcanized into a single piece with no joints, voids or splices which can develop into breaks in the insulation. Even the best of the new conventional insulations combine several dissimilar materials which are held together by binders.

Heat Resistance — The excellent dielectric and mechanical properties in silicone rubber do not change significantly with aging at high temperatures over long periods of time.

Moisture Resistance — Completely sealed, *Silco-Flex* insulated coils are the most moisture-resistant coils ever produced.

Chemical Inertness — *Silco-Flex* insulation has outstanding resistance to most atmospheric contaminants, corona and weathering. It also withstands weak acids, alkalies and lubricants.

Flexibility and Resilience — *Silco-Flex* insulation remains flexible and resilient indefinitely under operating conditions. It is especially resistant to mechanical abuse and to the stresses brought about by overloading and rapid starting and stopping. It is also amazingly resistant to abrasion.

Heat Dissipation — Most electric insulators, unfortunately, are also heat insulators. *Silco-Flex* insulation, by comparison, is an excellent heat conductor and materially assists in removing heat from the coils.

What Are the Benefits?

The characteristics of this new insulation are so remarkable that complete reappraisal of motor application practices and motor performance is indicated.

In *all* applications, the chemical, mechanical and electrical properties of *Silco-Flex* insulation insure increased service reliability and longer life.

In addition, this new insulation system may reduce or eliminate the need for special motor enclosures. Atmospheres contaminated with cinders and fly ash, for instance, will have little effect on *Silco-Flex* insulated windings. Similarly, abrasive dusts in steel mills will not harm this insulation. Savings through the use of open, instead of totally-enclosed, frames will also be possible in chemical, paper, food and other industries where water or corrosive atmospheres are a problem.

What About Availability?

New *Silco-Flex* insulation is immediately available for all Class H form-wound coils and for Class A and B windings, operating under selected service conditions.

For complete information on SILCO-FLEX ***insulated motors, see your Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.*** A-4664

Silco-Flex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

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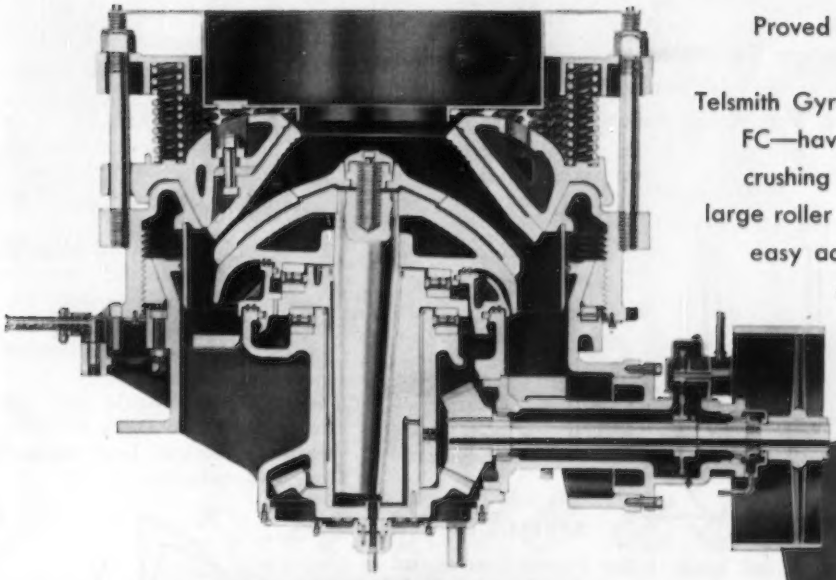
TELSMITH *Gyraspheres*

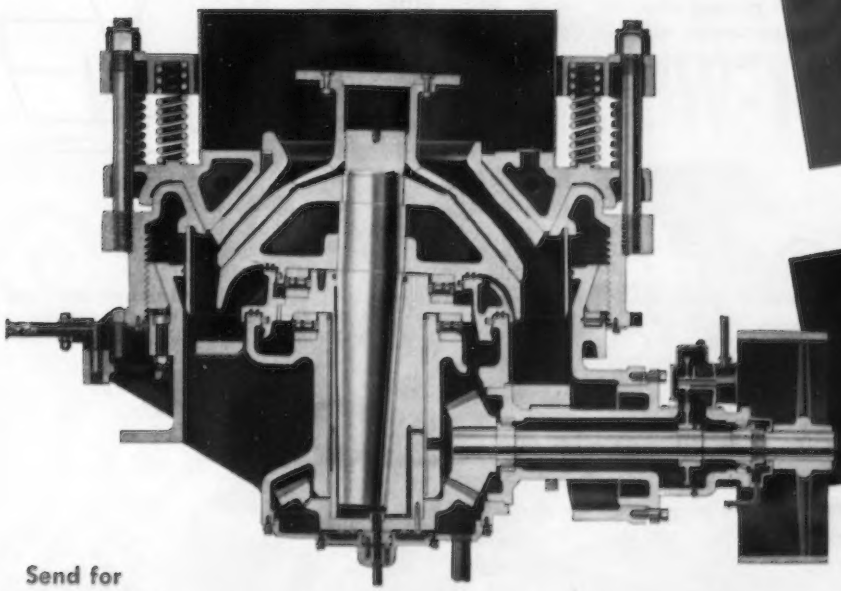
FOR MINES

Proved . . . operating everywhere . . . satisfying all crushing tests! Telsmith Gyraspheres—both Style S and FC—have long stroke, cam-and-lever crushing action, patented rotary seal, large roller thrust bearings, spring relief, easy accessibility—for big capacity, uniform cubical product, and low-cost operation.



STYLE S
for coarse crushing
takes choke feed

STYLE S—24 to 48-inch sizes: 3½ to 9-inch feed openings; 10 to 320 tons per hour.



STYLE FC
for fine crushing

STYLE FC—24 to 48-inch sizes: 2½ to 4-inch feed openings; 6 to 130 tons per hour.

Send for Bulletin 274

Y-14-Min.

SMITH ENGINEERING WORKS
502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**
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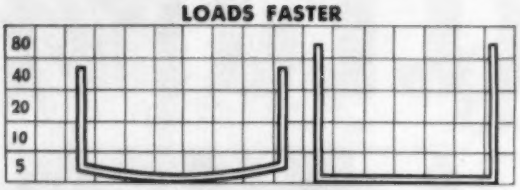
Compare these dirt-moving features before you buy

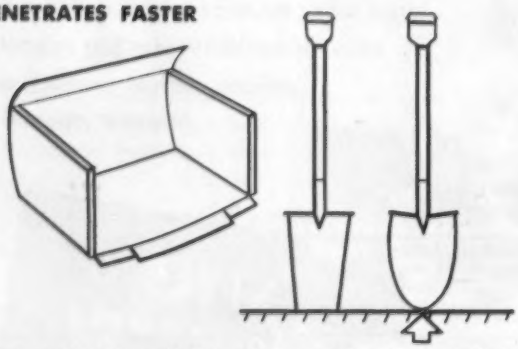
Check over these Allis-Chalmers TS-200 Motor Scraper features point by point. See for yourself how performance makes dollars when design makes sense.

LOADS FASTER



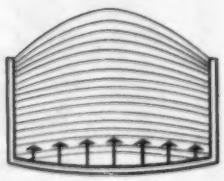
Tests have proved that loading resistance is largely determined by the height to which the load is built. That's why the lower, wider bowl of an Allis-Chalmers Motor Scraper requires less time and power to get the same yardage.

PENETRATES FASTER



The penetrating ability of a round-end spade helps illustrate how the curved and offset cutting edge on Allis-Chalmers Motor Scrapers concentrates all the horsepower on the center section during initial penetration.

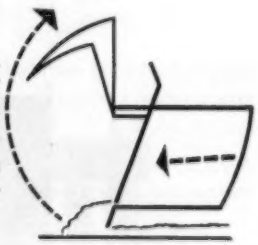
HEAPS AUTOMATICALLY



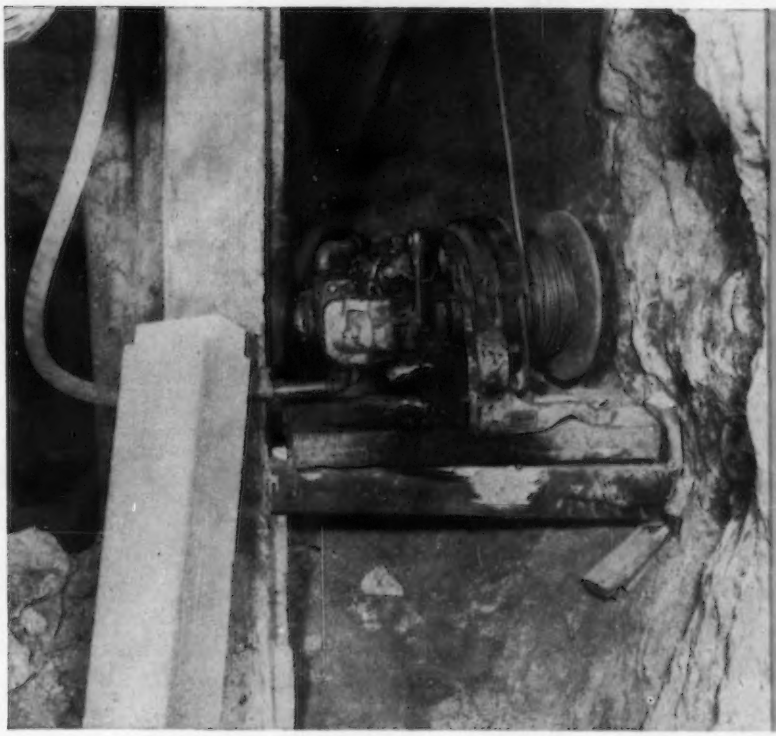
The combination of slightly deeper center cut and correctly angled cutting edge shapes the load as the scraper fills. The greater volume of dirt flowing into the center of the bowl "boils" forward, to the rear and to the sides, producing an automatically heaped load without excessive spillage.

SPREADS EVENLY

Forward movement of ejector is timed with lifting action of apron, which provides a continuous flow of material to insure a smooth, even spread. High apron lift prevents any possibility of material's jamming.



Write for literature and additional information on this earth-moving value or see your Allis-Chalmers dealer.



ODD JOBS?

...they're a cinch

with a JOY DW-111 HOIST

This is the portable hoist to take care of those time-consuming chores in and around the mine. With the least amount of time and effort, too, and *with maximum safety.* Lifting capacity is 1300 lbs. Rope speed, 80 ft. per minute. Power is by our reversible, 4-cylinder, 4 HP Pistonair Motor. AUTOMATIC SAFETY BRAKE holds the load in any position when throttle is in "off" position.

Other Joy multipurpose hoists—air or electric drive—with lifting capacities ranging from 500 to 3500 lbs. are available to take care of your light or heavy lifting. All models are rugged and compact, suited for rough handling underground and for operation in tight spots. Complete information on all Joy single drum hoists is in Bulletin 76-X. Write for your copy today to **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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for AIR COMPRESSORS, ROCK DRILLS, HOISTS AND SLUSHERS

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WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

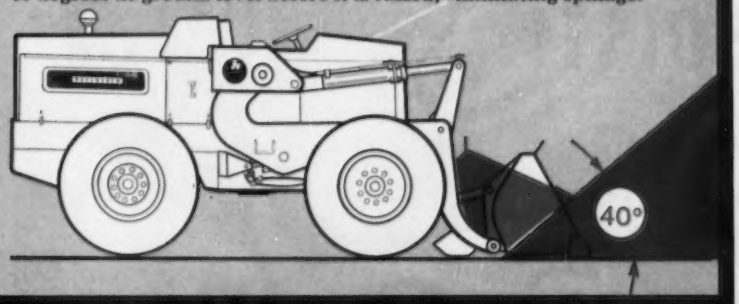
only these **2** completely different

PAYLOADER® TRACTOR-SHOVELS

offer you all these features...

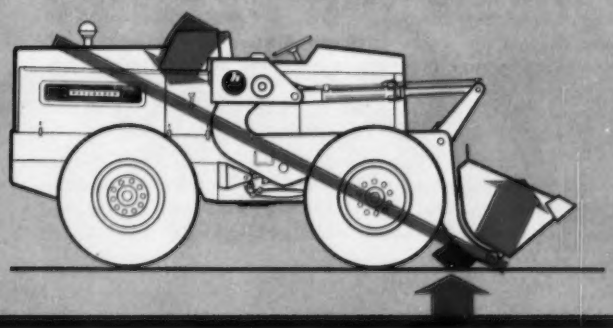
40 DEGREES BREAKOUT AT GROUND LEVEL

You can get HEAPED BUCKET LOADS and you get them FASTER and EASIER WITH THIS NEW BUCKET ACTION. Most important of all—you KEEP BIGGER PAYLOADS—because the bucket can be tipped back a full 40 degrees at ground level before it is raised, eliminating spillage.



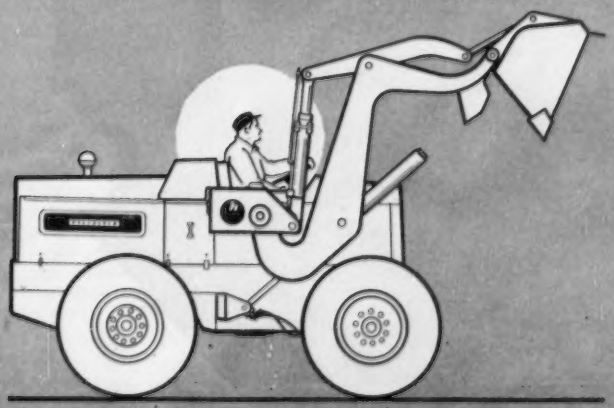
POWERFUL PRY-OUT ACTION

Tremendous pry-out force is obtained by using the breakout pads on the ground as a fulcrum for leverage. The load forces opposing the pry-out action are thus transferred to the ground through the pads instead of to the axle, wheels and hydraulic system of the machine.



SAFETY AND STABILITY

Underslung boom-arm design keeps moving members out of operator's reach at all positions—without using safety guards and screens. Longer wheel base and close, low, load-carry position provide maximum stability and balance.



HOUGH-DESIGN
HOUGH-QUALITY
HOUGH-PERFORMANCE

more horsepower

per bucket capacity than any other wheel tractor-shovel. Either gasoline or diesel power available.

easy to operate

Fullest operator visibility for safe, fast maneuvering; power-steering; minimum number of control levers. Foam-rubber molded seat and back cushions. Seat adjustable for operator comfort. Longer wheelbase and better balance add to riding comfort.

accessibility

Unusual accessibility for servicing and maintenance. Battery and oil reservoir are located under an easy-access cover just behind driver's seat. Sealed grease fittings. Exterior hydraulic line outlet provided for easy addition of hydraulically-operated accessories.

torque-converter drive

in conjunction with 4-speed, full-reversing transmission provides precise, easy control and the widest possible range of speeds for both forward and reverse. Acts as a shock-absorber for the entire power train.

other features

Closed, pressurized hydraulic system to keep dirt and air out of oil; powerful hydraulic brakes; double-acting hydraulic cylinders and chrome-plated piston rods; 12-volt electric systems on gas-powered models; forward and backup driving lights; tail lights.

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YOU CAN FIND A SURE CURE for a "hoisting headache" with a BROWNIE HOIST!

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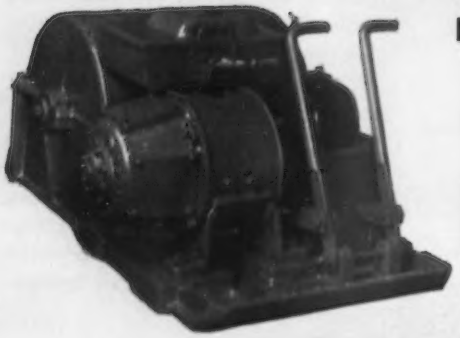
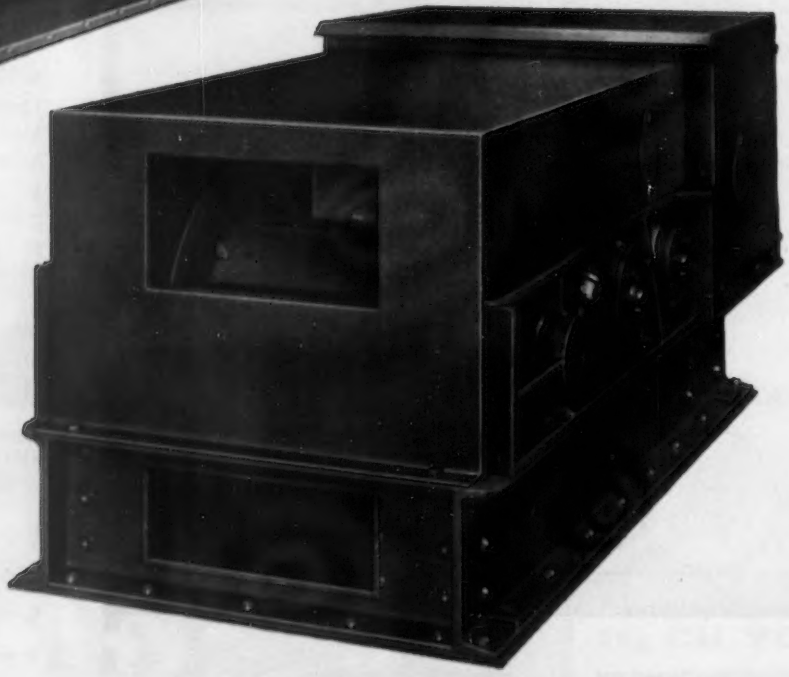


IN MINING OF ALL TYPES, there's no haulage hoist problem that cannot be handled by a "BROWNIE". Hoists with a reputation of long standing for dependable service and the ability to take the punching of constant haulage. For almost 40 years we have devoted our entire engineering know-how to mining requirements. Among our various types and models available are hoists with rated capacities from 2,000 to 24,000 lbs. rope pull and with speeds from 25 to 300 feet per minute.

And now, remote push-button control is available to save time where practicable. Let us discuss your problems with you for greater efficiency and more effective service. Brown-Fayro Division of SANFORD-DAY IRON WORKS, P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tennessee.



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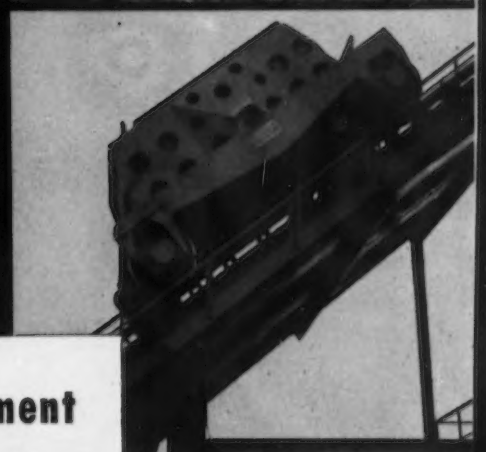

For profitable high speed mining equipment use USS High Strength Steels

USS HIGH STRENGTH STEELS can give your 'dozers, shovels, cars and draglines the strength and stamina they need to work faster and last longer—to boost production, to cut repair costs. That's because these famous steels have a 50% higher yield point, and greater resistance to wear, impact, abrasion, and fatigue than carbon steel.

USS TRI-TEN STEEL gives you high strength plus high resistance to impact at low temperatures. This tough, versatile steel is ideal for use in heavy-duty equipment which must operate in subzero weather. For it retains its toughness and withstands shock under low temperature conditions. Will keep your shovels, draglines and 'dozers going when others fail.

USS COR-TEN STEEL gives you high strength plus high resistance to corrosion. This high strength steel has 4 to 6 times the resistance to atmospheric corrosion of structural carbon steel. This property helps to assure long life and low maintenance cost in mine cars and similar equipment that must operate under corrosive conditions.

USS MAN-TEN STEEL gives you high strength plus resistance to abrasion. This lower-cost grade has a higher resistance to abrasion than carbon steel. In addition to high strength and toughness, it has workability and weldability to a higher degree than obtainable in carbon steel at the same strength level.

USS HIGH STRENGTH STEELS can be used singly or in combination to replace carbon steel in the vital parts of your mining equipment to increase service life without increasing dead weight. And, if the use of thinner sections is possible, they can (1) reduce equipment weight without reducing its strength, or (2) increase the size and capacity of equipment without increasing the total weight or the power needed to move it.

For more information call or write our nearest office.

NOW AVAILABLE—Our new "Design Manual for High Strength Steels" is ready for distribution. This excellent book contains comprehensive and practical information that you will find extremely useful in designing your product for greater economy and efficiency by the sound use of high strength steels.

For your free copy, write on your company letterhead giving your title or department. United States Steel Corporation, Room 4757, 525 William Penn Place, Pittsburgh 30, Pa.

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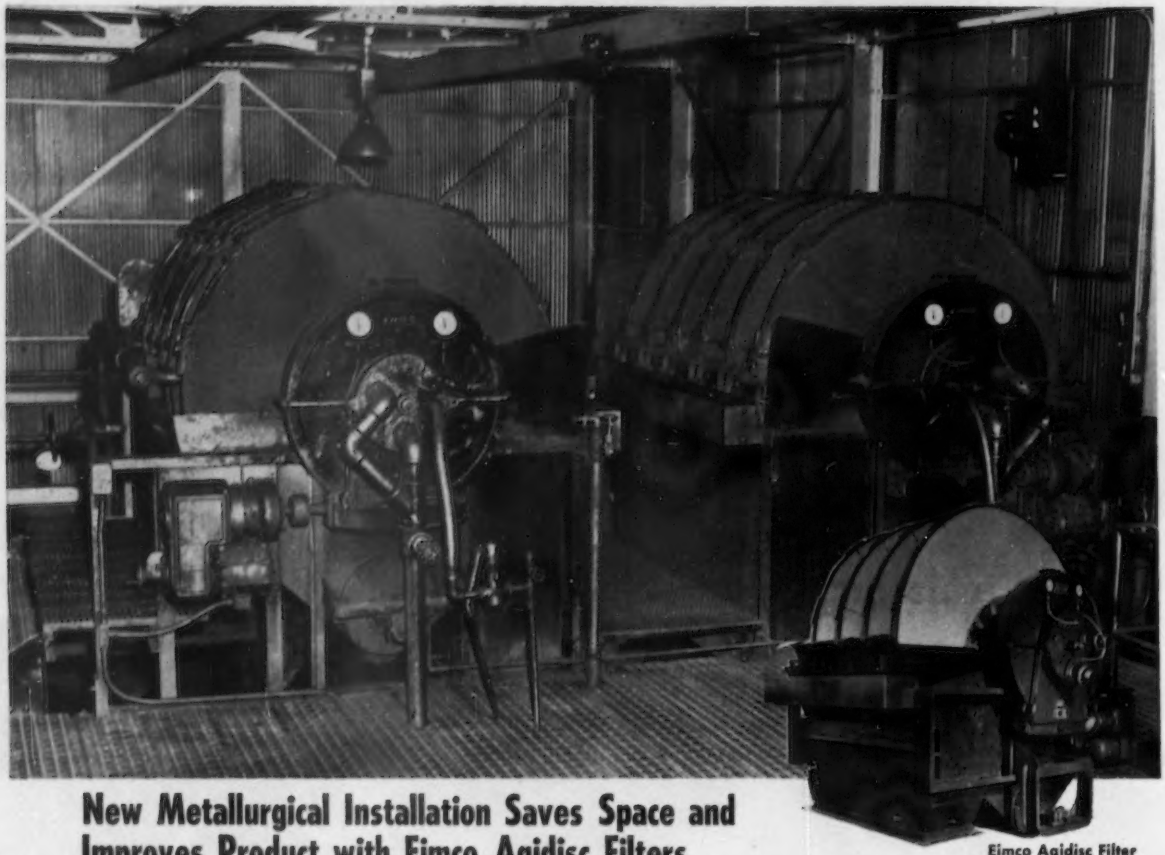
USS HIGH STRENGTH STEELS

UNITED STATES STEEL



Eimco Agidisc Filter

New Metallurgical Installation Saves Space and Improves Product with Eimco Agidisc Filters

The photo above shows an installation of two 6' diameter by 5 disc Eimco Agidisc Filters in their operating position in a new metallurgical concentrating plant.

These filters were installed as a result of the owner company and Eimco cooperation in a joint effort to improve the operation of the filter station at this plant and reduce moistures with the most economical equipment.

After the installation had been operating for six months the following data was made available.

	PREVIOUS EQUIPMENT	NEW EIMCO FILTERS
1. Concentrate handled	350,000 lbs./24 hrs.	350,000 lbs./24 hrs.
2. Labor required	1 man full time	1 man part time
3. Attention required	Constant inspection	Periodical inspection every 6-8 hrs.
4. Operating Capacity	Full load—no capacity for additional tonnage	½-¾ load—capacity for 33% to 100% additional tonnage
5. Equipment	4—Drum filters (not Eimco)	2—6' dia. x 5 disc Eimco Agidiscs
6. Filter area	621 sq. ft.	500 sq. ft.
7. Floor Space occupied	416 sq. ft. filters only	189 sq. ft. filters only
8. Cake Moisture	20%—21%	14%—15%
9. % Moisture reduction over previous method		33%
10. Filter rate increase over previous method		more than 15%

Eimco specializes in equipment to do a better job in filtration. Before you buy, take advantage of Eimco's experience in building filtration equipment for customers who look beyond first cost to get quality construction, individual design and guaranteed performance.

THE EIMCO CORPORATION
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City
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CONTINUOUS PRESSURE
PRESSURE PRECOAT
BI-CARB
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BURWELL

ONE EXTRA CYLINDER—and everything hauls smoothly

ATLAS COPCO AIR WINCHES

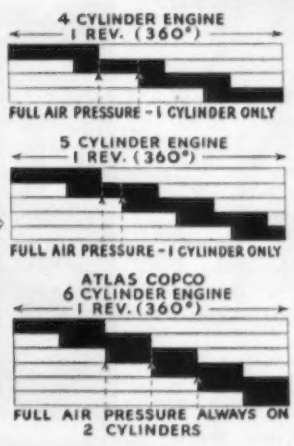
are made in a range of sizes to meet every need. Here is a series of light, powerful and easily portable winches especially developed for dragging, skidding or lifting in mines, quarries, industrial plants or on construction jobs. They are equally useful for moving and spotting cars at underground loading stations, shop yards etc. etc. They are simple to operate, maintain, and have a low air consumption. They can be easily and quickly moved from job to job and set up without delay. While they are very fast and smooth they can be run from creep to full speed under perfect control. All safety features required by the most stringent mine and industrial safety codes are fully covered.

Atlas Copco Air Winches are well worth knowing more about. For specifications, performance figures and detailed technical data, post the coupon below for illustrated leaflet.

ATLAS COPCO AIR WINCHES

—with six-cylinder radial piston engines

Some air winches have five-cylinder motors. Others, only four. Atlas Copco Air winches have **six.** That's the great thing about them. It not only means a compact motor and smoother hauling from creep to full speed, but a **much more powerful starting torque.** This is clearly illustrated by the accompanying tables. It will be seen that only the Atlas Copco six-cylinder motor always has complete power overlap on two cylinders.



Atlas Copco Compressed Air Equipment is manufactured or sold and serviced in 48 countries throughout the world by *The Atlas Copco Group*, which embraces companies trading under various names such as Atlas, Atlas Diesel, Atlas Polar, Atlas Copco, Copco, Delfos and Sampa.

**Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment.*

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POST THIS COUPON to the most convenient of the addresses given here:

U.S.A., Copco Pacific Ltd., 930 Brittan Avenue San Carlos, California; Copco Eastern Ltd., P.O. Box 2568, Paterson 2, N.J.; CANADA, Canadian Copco Ltd., Montreal, A.M.F., Quebec; MEXICO, Atlas Copco Mexicana, S.A., Apartado Postal 56, Torreon, Coahuila; PERU, Compania Atlas del Peru, S.A., Apartado 2982, Lima.

UNITED KINGDOM, The Atlas Diesel Co. Ltd., Wembley, Middx.; FRANCE, Atlas Polar S.A., 29, Rue Marbeuf, Paris 8e; HOLLAND, N.V. Holland-Atlas, P.O. Box 6056, Rotterdam; ITALY, S.A.M.P.A., Viale Marche 15, Milan.

AUSTRALIA, Australian Atlas Company Pty., Limited, P.O. Box 54, Auburn, N.S.W.; SOUTH AFRICA, Delfos (Pty) Ltd., P.O. Box 504, Benoni, Transvaal.

Readers in countries outside those listed above and who do not know the name of their local Atlas Copco company or agent, please write, in the first instance, to AB Atlas Diesel, Stockholm 1, SWEDEN.

Please forward details of ***Atlas Copco Air Winches*** *(leaflet E.865)*

NAME _____

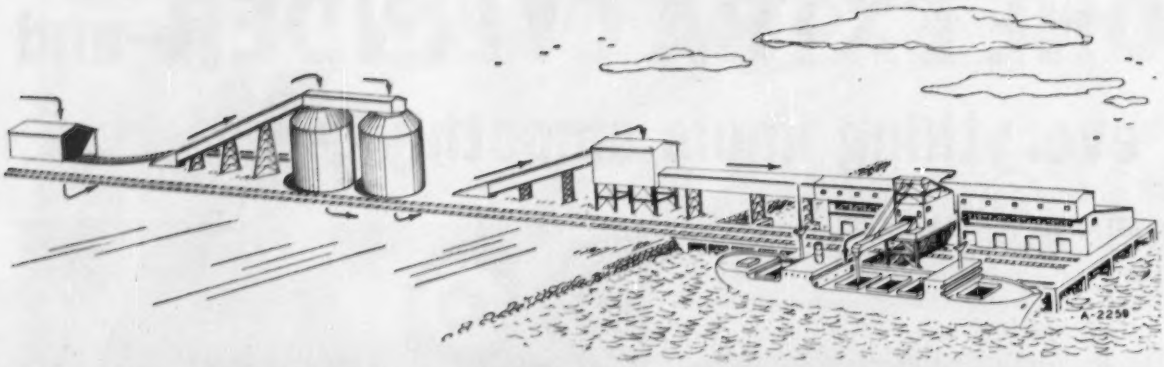
COMPANY _____

ADDRESS _____

_____

* I am also interested in other Atlas Copco Equipment (please state which below).

_____ /2



Moving JAMAICA ALUMINA TO CANADA— Economically

It's a long haul from Port Esquivel, Jamaica, to Kitimat, British Columbia. It is the combination of economic hydro-electric power developed by the Aluminum Company of Canada and reduced handling costs in the transport of pure alumina that makes this 5,000-mile production line a sound industrial enterprise.

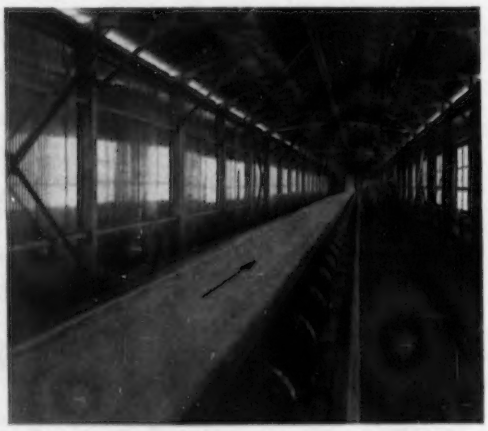
To help do the job, special port facilities in Jamaica were designed and furnished by Stephens-Adamson. Here bulk alumina is moved, stored and loaded directly into ships' holds at a 660-tons per hour rate. The facilities and equipment are engineered to hold handling time and labor to a minimum and to make maximum use of shipping space.

To reduce shipping costs, raw bauxite is reduced to pure alumina in operations adjacent to the mine. It is brought to dockside in rail cars and discharged to a track hopper. A 30-inch belt conveyor takes it to two huge silos, each holding 10,000 tons.

When a ship arrives for loading, alumina is withdrawn from storage by a 48-inch belt conveyor. From a transfer house, another conveyor runs along a gallery parallel to the dock. A traveling tripper feeds to a traveling gantry boom discharging through a chute to an S-A ship trimmer that throws alumina to all parts of the hold for uniform loading.

This efficient loading and handling system is a good example of S-A engineering at work. For any bulk handling job, S-A is at your service to help you cut your bulk handling costs. Write for a free survey—no obligation, of course.

48-inch belt conveyor, supported by traveling gantry, feeds alumina to S-A ship trimmer at rate of 660 tons per hour. High speed belt throws alumina to farthest corners of hold.



Conveyor gallery running parallel to dock. Tripper in background feeds alumina to boom belt conveyor.

SINCE 1901 S-A STEPHENS-ADAMSON MFG. CO.

STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif. • Belleville, Ontario

Engineering Division
Specialists in the design and manufacture of all types of bulk materials conveying systems.

Standard Products Division
A complete line of conveyor accessories including centrifugal loaders—car pullers—bin level controls—etc.

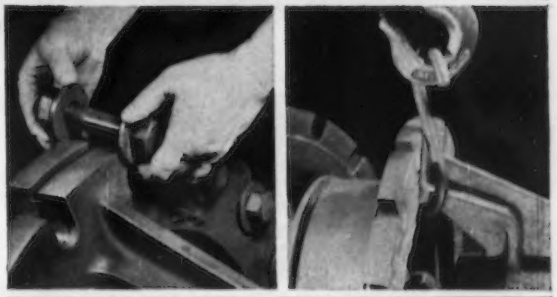
Sealmaster Division
A complete line of industrial ball bearing units available in both standard and special housings.

Here's what we mean by LOW-COST MAINTENANCE

ALLIS-CHALMERS Solids Handling PUMPS

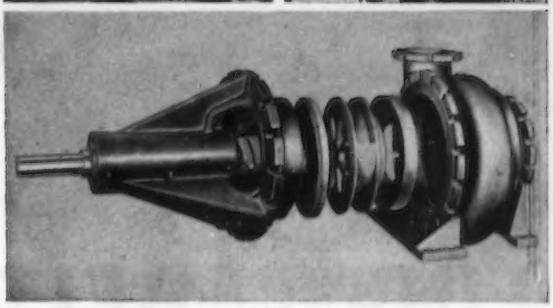
1 Troubles are few and far between

One user of Allis-Chalmers solids handling pumps said, "We've been operating them for 8 months without loss of capacity." . . . another said, "We ran it for 13 months before we replaced the first part."



2 Inspection is an easy routine

Take-down and re-assembly require less than half an hour. Merely disconnect the drive . . . loosen the nuts on casing bolts . . . and lift out the bolt assemblies. Then, swing out the rotating element. There's no need to disturb the suction or discharge piping.



3 Parts replacement is fast, economical

Wear is limited because there are only five wearing parts. Many parts are interchangeable among several sizes of Allis-Chalmers solids handling pumps so you won't have to carry big spare parts stocks. What's more, because parts replacement *is* infrequent . . . because it's so fast and simple . . . down-time production interruptions are held to a minimum.

In addition to sound design, Allis-Chalmers solids handling pumps feature special hard alloy *Ni-Hard* and extra thickness of metal in critical spots. Then, too, each A-C pump is application engineered to meet the specific conditions under which it will be used.

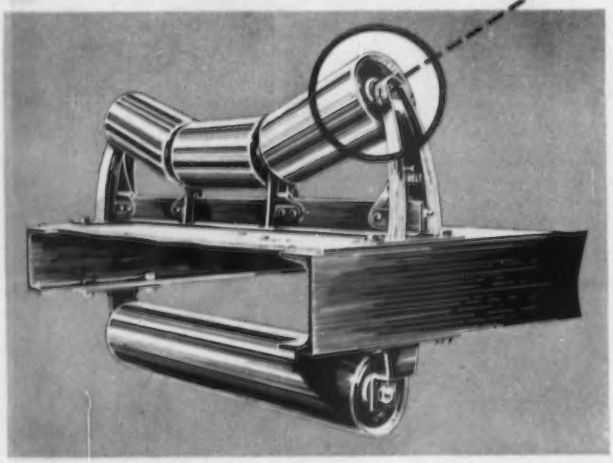
Remember, Allis-Chalmers can furnish the complete pumping unit—pump, motor, control and drive. Next time you need a solids handling pump, call your A-C representative or write—Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 52B6381.

A-4603

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

For longer idler life . . . here's 3-WAY protection in ONE simple, compact cartridge seal



THE effectiveness of Link-Belt cartridge grease seals in protecting belt conveyor idler bearings is matched by no other in industry. Besides the normal high efficiency of Link-Belt's labyrinth and contact seals . . . grease within the labyrinth further prevents entry of dirt or other particles. This cartridge (see above cutaway) is one integral unit—no springs, no loose washers . . . no possibility of metal-to-metal contact. From shaft to shell—bearings, fittings, rolls, frames, even hex nuts are designed for long, trouble-free life.

Also important, you can always find the *right* idler in industry's most comprehensive line—over 500 idlers in 34 types, built in a broad range of roll diameters and belt widths with matching return idlers. Ask your Link-Belt sales representative or authorized stock-carrying distributor for 48-page Book 2416, which covers this broad line thoroughly.

LINK-BELT

BELT CONVEYOR IDLERS

LINK-BELT'S superior grease seal is standard throughout industry's most comprehensive idler line

Series 100 Idlers
Continuous service for all but heaviest and coarsest materials.

Series 200 Idlers
Continuous service for heaviest and coarsest materials.

Series 400 Idlers
Continuous service for maximum volume per lineal foot of belt.

Series 500 Idlers
For greater volume than series 100 at maximum economy.

Series 600 Idlers
For grain and similar materials requiring only light belts.

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

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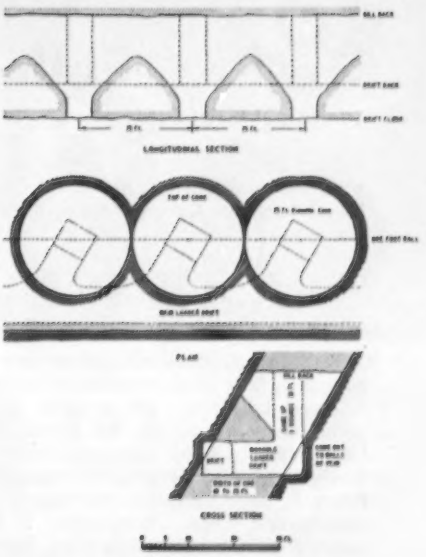
INCREASE PRODUCTION LOWER COSTS

Yes! You can increase production and lower costs by using Eimco loaders to load your production tonnage.

The advantages of being able to load larger pieces, use less powder, practically eliminate secondary blasting and absolutely eliminate expensive chutes and grizzlies, will enable your mine to get into production in a new area faster at less expense.

That's why so many mining men are traveling to see mines that have changed their systems to production loading with Eimcos.

Many different ideas for saving time and lowering costs have been developed by operators to fit their particular conditions. A sketch of one of these is at right. Eimco engineers have helped work out numerous systems, they will be glad to help you. Write Eimco for information.



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You Can't Beat An Eimco

Jones & Laughlin *uses many*

Fuller Rotary Compressors

Like many other steel producers and fabricators, from the East to the West Coast, Jones & Laughlin Steel Corporation has purchased and uses many Fuller Rotaries in its various mills. Illustrated above is a Fuller Rotary Two-stage Compressor, having a capacity of 1660 c.f.m. 120-lb. pressure, installed in the P-1-10″ bar mill of the Pittsburgh Works Division.

Endurance, plus efficiency and maintained capacity, flow of air without pulsations, elimination of vibration, are results of the rotary principle employed in the design of the Fuller Compressor. They can be placed on comparatively light foundations, on balconies or upper floors to save valuable floor space and shorten distribution lines. Employing a minimum of moving parts—rotor, bearings, blades—greatly reduces maintenance and eliminates adjustments entirely.

The cylinders of a Fuller two-stage machine are at ground level, mounted on a common base plate, and are connected by a flexible coupling. Installation is very simple, the motor being lined up to the coupling on the shaft extending from the low-pressure cylinder. This arrangement simplifies motor maintenance work as compared with many other types of machines.

Due to extremely low inertia and WR^2, Fuller compressors, which operate in speed ranges of 600 to 1750 r.p.m., according to size, and are directly coupled to the motor, may be installed with either a general purpose or a normal torque synchronous motor, as dictated by size and the electrical requirements of the plant. Standard motors are available for all sizes of Fuller compressors in either squirrel cage or synchronous types.

For full information, write for Bulletin C-5A.

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PIONEERS OF HIGH-EFFICIENCY VANE-TYPE ROTARY COMPRESSORS

FACING A TOUGH PROPOSITION?

you can beat it

with **JALLOY**

JALLOY HEAT-TREATED STEEL PLATE BEATS WEAR DUE TO IMPACT AND ABRASION

Jalloy Plates outlast other steels by margins of 4 to 1

Jalloy Aprons in Tyrock screen last 3 times as long as other steels

Jalloy lowers maintenance costs on ore and coal conveyors

Jalloy provides longer wear with less repair in truck bodies

Jalloy Heat-Treated Plate is the special purpose steel that is heat treated to provide longer wear on applications where impact and abrasive conditions are severe.

In comparison with other abrasion-resistant steels as well as mild steels, it gives optimum results when heat treated, to a Brinell hardness of 340 and up. Jalloy permits savings in steel costs, maintenance, and repair. Furthermore, it is easily welded. Jalloy is available in three grades—1, 2, and 3 to meet various service requirements.

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Jones & Laughlin

STEEL CORPORATION — Pittsburgh

Complete data concerning CHEMICAL COMPOSITION . . . HEAT TREATMENT . . . WELDABILITY . . . PHYSICAL PROPERTIES . . . will be mailed to you promptly. Write today.

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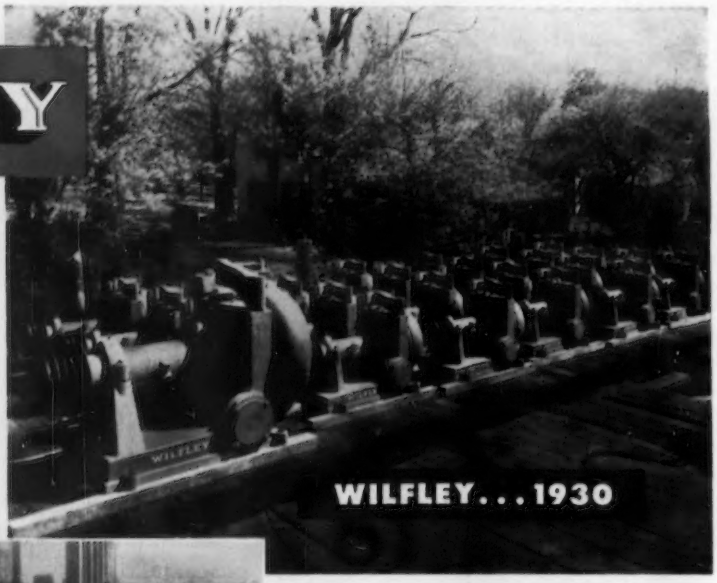
WILFLEY

...Advances with the Mineral Industry



Progress in Low-Cost Pumping

Top photo (right) shows part of a large shipment of Wilfley Model "C" Sand Pumps ready for delivery to a large nickel producer.

25 years later this same company still depends on Wilfley for low-cost pumping. Shown in bottom photo is part of a large shipment of Wilfley's new Model "K" pumps on their way to the same customer.

The name Wilfley means continued progress in efficient, economical pumping. Wilfley keeps pace with mineral production throughout the world by designing and manufacturing pumps that definitely deliver cost-saving performance on every application.

Write or wire for complete details on Wilfley Pumps

Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Sand Pump

A. R. WILFLEY and SONS, INC. Denver, Colorado, U. S. A.
New York Office: 1775 Broadway, New York City

Two Excerpts from an Annual Report

Green light for a new mine. "The most important result of exploration during 1954 was the discovery of lead-zinc-copper-silver orebodies on the Little River property near Newcastle in New Brunswick, Canada . . . Heath Steele Mines, Ltd., a private Canadian company, owned 75% by your company and 25% by International Nickel, was recently formed to continue development of the Little River property.

. . . A target date of late 1957 has been set to bring the property into production at a rate of approximately 1,500 tons of ore per day, with provision for expansion if justified by future developments."

Hesitation. "Most of your Company's ore reserves in Mexico will be mineable only if existing export and production taxes are sharply reduced. The company now awaits action on specific relief that has been promised by the Mexican Government in respect of 1954. Negotiations continue for additional relief for the future. The outcome of these negotiations will determine the company's program for the mining of its Mexican ore reserves and the carrying on of the development work required to prolong the lives of the mines."

. . . and What They Mean to Mining

The two excerpts above, chosen at random from numerous annual reports published recently, reveal a significant pattern—that capital for the development of mineral resources will flow to areas establishing a "favorable climate" for such ventures.

Studying this report and many others, we find quite consistently that venture and development capital seeks areas where freight rates are moderate, taxes are reasonable, inflation is under control, exchange controls are not confiscatory, export taxes are realistic, and national pride does not spill over into the area of expropriation.

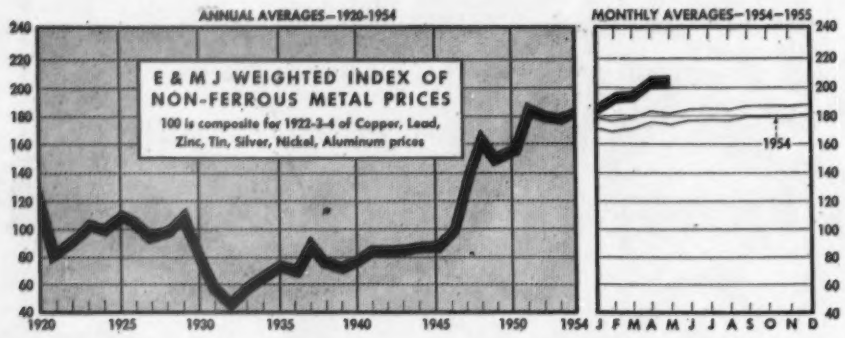
Examples of sound national policy which have attracted venture capital are: Peru's recent successful internal efforts to stem inflation and stabilize the sole; Canada's generous tax relief to new and struggling mining projects; Southwest Africa's liberal terms offered to responsible companies seeking to develop mineral wealth.

Each nation enjoys the freedom of formulating its own policies, but it cannot escape the respective economic rewards or penalties that go with prudent or imprudent judgment in the formulation of such policies. Thus, those nations which enjoy increasing prosperity today as a result of cooperation with venture groups are the nations which have adopted realistic laws and policies.

In summary, we emphasize that venture organizations leave real and lasting values in foreign lands that exceed the importance of dollar exchange. A survey of important Latin American mining properties will reveal barren tundra which have been transformed into productive enterprises affording thousands of inhabitants with modern transportation, power facilities, hospitals, schools, churches, houses, better living standards, improved health records and more nutritious diets. These are the real assets upon which nations can build.

E&MJ OUTLOOK

PRICES



MARKETS

Higher monthly averages for zinc, foreign silver and tin caused the *E&MJ* price index to rise from 207.36 in April to 208.08 in May, a new high.

Copper continued in tight supply throughout May and the "squeeze" will carry over into June, particularly so where London Metal Exchange contracts are concerned. However, mine output is rising in nearly all major producing areas.

Despite heavy U.S. production of aluminum and fairly large imports from Canada, apparent consumption here has exceeded total supply. And all this without upward pressure on primary prices.

Foreign silver prices approached the level at which the U.S. Government has been acquiring domestically produced metal. Improved European industrial demands, plus recent withdrawals for currency purposes, tightened the supply.

●

LABOR

Industry is cracking down on unauthorized labor stoppages. Westinghouse furloughed 1,100 workers at East Pittsburgh for six days for an unauthorized walkout. Calumet & Hecla fired 1,848 workers at its Calumet, Mich., division who allegedly struck without notifying the proper mediation authorities, and walked away from furnaces filled with molten metal.

If Ruether succeeds in gaining guaranteed annual wage concessions in the automobile industry, Mine-Mill will push harder for similar benefits in the metal mining industry. See page 105.

●

AT HOME

Diversification is responsible for changing corporation names. Anaconda Copper Mining Co. will soon change its name to the Anaconda Co. Anaconda's new board chairman, Roy H. Glover, said the company is planning diversification in "any appropriate field where it can be of service."

When the three taconite projects now under way in Minnesota reach full production, investments in this single-product industry will exceed the total of all other private investments in the State of Minnesota.

An Interstate Commerce Commission hearing on the proposed extension of temporary 12 to 15% freight rate increases has been set for Sept. 26. See p 105.

At least three manufacturers exhibiting mining equipment at the recent American Mining Congress Coal Show in Cleveland reported that high city taxes on inventories of supplies and manufactured equipment had slowed down their ability to meet orders. Reason—inventories were clipped too much in the face of an underestimated 1955 domestic industrial boom.

●

ABROAD

Canadian zinc production for the first quarter of 1955 rose to 105,230 tons, 29% higher than for the first quarter last year.

Orinoco Mining Co. exported 1,468,902 tons of iron ore to the U.S. during the first quarter of 1955. OMC has signed contracts to export 400,000 tons to England, and 500,000 tons to Germany in 1955.

Record Consumption of Metals in May; Rhodesian Copper at "Fixed" Prices

PURCHASING AGENTS maintained that business conditions are good and May turned out to be another "banner month." Producers of major nonferrous metals would have to agree with this statement. As for some months past, the high rate of activity in the automobile and construction industries stimulated business in all directions. Though some decline in activity is generally anticipated for the summer period, the outlook is much better than earlier estimates indicated.

The price structure was remarkably firm, notwithstanding evidence of a rising trend in production, particularly in copper. Heavy European demands continued to upset the calculations of those who thought an oversupply in some metals would become visible around mid-year. Stockpiling of copper and aluminum has moderated by diverting such shipments to industry to relieve a tight supply situation. There was talk of another round of expansion for the aluminum industry as the month ended. Steel producers are beginning to wonder whether capacity in that key industry is sufficient to take care of the expanding needs of consumers. Production of steel in the United States for the first half of 1955 was estimated at around 57-million tons, the highest rate on record.

Higher monthly averages for zinc, tin and foreign silver raised the *E&MJ* price index for May to 208.08, a new high, which compares with 207.36 in April and 183.26 in May last year.

Though copper shortages were relieved somewhat by tonnages released by the U. S. and British governments, a tight situation continued throughout May. Consumers obtained encouragement from recent statistics of the industry that clearly pointed to an expansion in output. So far, however, the demand appears to have kept pace with increased output. Most producers expect an improved supply situation in copper for the second half of the year. The demands, some contend, have been in excess of actual needs.

The long-debated Chilean copper bill relaxing conditions under which the large producers operate in that country was finally enacted into law. The measure became operative on May 5. The new law ends discriminatory exchange rates, places control of sales in the hands of the producers, and modifies the tax setup, relating it to output. The "Copper Department" retains the right to supervise the marketing of Chilean copper. Some months will have to elapse before the new regulations become fully effective. If inflation can be controlled in Chile the new law should tend to stabilize conditions in the industry.

Roan Antelope and Mufulira, Rhodesian producers, in a move to stabilize copper prices in the U. K., announced on May 2 that they have decided to offer fixed prices for copper to those of their customers in the U. K. who are willing and able to instill a degree of stability into the resale prices for copper and brass products. Effective May 9, these companies named a fixed price of £280 per long ton, c.i.f. British ports. It was announced that this price will hold for a period of 30 days, after which it will be subject to change on 24-hour notice. The selling basis is equivalent to about 35c per pound, U. S. currency.

Prices dropped sharply on the London Metal Exchange, following this announcement, but gradually recovered as buyers outside of the U. K. soon learned that offerings in the outside market remained light. In brief, the squeeze in Europe continued, with the speculative market still in an oversold condition.

Statistics of Copper Institute for March and April, in tons, are summarized as follows:

United States

Production:	(a) Mar.	Apr.
Crude, primary	98,171	93,413
Crude, secondary	10,239	10,468
Total	108,410	103,881
Refined	135,701	122,129
Deliveries, refined	131,354	119,863
Stocks, refined	46,091	42,759

Outside United States

Production:	(a) Mar.	Apr.
Crude, primary	133,530	138,161
Crude, secondary	319	283
Total	133,849	138,444
Refined	101,825	102,396
Deliveries, refined	103,764	101,552
Stocks, refined	148,973	158,076

(a) Corrected figures.

Production of primary crude in April (combined U. S. and foreign) was at the daily rate of 7,719 tons, a new high for the movement, which compares with 7,474 tons in March.

U. S. fabricators shipped the equivalent of 115,073 tons of copper to their customers during April, against 143,544 tons in March, the month that saw another price advance. In the first four months of 1955, apparent consumption of copper in the U. S. was at the rate of 128,485 tons a month.

Lead and zinc stockpiling "could" be continued in the 1956 fiscal year. That was the verdict of most authorities after reading a letter by ODM Director Flemming to Senator Bennett of Utah. "The Government," he wrote, "will be in a position to continue to acquire both lead and zinc toward long-term stockpile objectives in 1955, and, it would appear, throughout 1956. In the meantime, we are continuing to exert every effort through other appropriate action and programs that can in any way contribute to a bettering of the domestic lead-zinc situation."

Demand for both lead and zinc continued at a high level and prices were firm. In zinc, still underpriced in the opinion of domestic producers, the undertone was strong with rumors of a higher market before long. Improved European consumption has reduced offerings of foreign metal in this market.

Columbian-tantalum turned out to be the first of nine long-range Government programs to be completed in the matter of building a reserve of strategic and critical materials. Receipts, plus forward commitments, have reached the goal of 15-million pounds that GSA has been authorized to buy. The trade was really surprised on learning of this development and the price structure was badly shaken. As the month ended quotations were wholly nominal. Various bills have been introduced in Congress to extend U. S. buying programs for several years.

Average Prices for May (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	35.700
Electrolytic, export, refinery	36.187
Lead:	
Common, New York	15.000
Common, St. Louis	14.800
Silver and sterling exchange:	
Silver, New York, per oz.	88.928
Silver, London, pence per oz.	77.214
Sterling Exchange, "Checks"	279.588
Zinc:	
Prime Western, East St. Louis	12.000
Prime Western, delivered (g)	12.500
Tin:	
New York Straits	91.380
New York, 99% min. (e)	90.380
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$302.920
Antimony (E&MJ) (d)	31.970
Antimony, bulk, Laredo	28.500
Antimony, in cases, Laredo	29.000
Platinum, refined, per oz.	$78.500
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	23.200
Magnesium, ingot	28.500
Nickel (f)	64.500

Domestic quotations unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

MARKETS

ODM has released 3-million pounds of nickel to industry for June delivery to relieve the shortage. None of the nickel will come out of the national stockpile.

Quicksilver was lower in price as new purchases dropped off and selling pressure developed, largely in the Mexican product. Statistics of the Bureau of Mines indicated that "apparent consumption" increased from 9,500 flasks in the final quarter of 1954 to 19,500 flasks in the first quarter of 1955. A large chlorine and caustic soda plant at Muscle Shoals, using mercury cells, was put into operation, which caused the jump in use. Most of the increase in consumption came out of stocks and had no impact on the market.

Manganese ore demand improved. With freight rates up, prices rose moderately. Turkish chrome was strong on prospects of a new barter deal, for wool.

"Free" Gold Market

International gold markets presented a rather quiet appearance during May. Reflecting more stable conditions, large sales of hoarded gold took place in France and the metal was absorbed by the Central Bank. Gold coins in most markets continued their slow decline. With political tension less of a factor the markets in the Far East were particularly unsettled. There were no Russian gold sales in May. Pick's World Currency Report quotes on "free" gold, per fine oz, as follows:

	COINS		BARS (12.5 kg)	
	Apr. 30	May 31	Apr. 30	May 31
NEW YORK, transit	....	....	$35.10	$35.10
MANILA	$39.75	$39.50	37.50	37.00
HONG KONG	39.75	39.50	38.00	37.85
BOMBAY	53.30	52.50	53.75	51.50
TANGIER	39.25	38.95	35.05	35.05
BEYROUTH	39.50	39.50	35.20	35.20
PARIS	39.80	40.20	35.95	36.25
BUENOS AIRES	44.00	42.75	38.70	37.90

Note: All prices are computed at the free or black market value of the U.S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

May 1955	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis
2	35.700	36.250	91.125	15.000	14.800	12.500	12.000
3	35.700	36.500	91.000	15.000	14.800	12.500	12.000
4	35.700	36.100	91.250	15.000	14.800	12.500	12.000
5	35.700	36.100	91.000	15.000	14.800	12.500	12.000
6	35.700	35.800	90.750	15.000	14.800	12.500	12.000
7	No Market	36.000	90.750	15.000	14.800	12.500	12.000
9	35.700	35.575	91.125	15.000	14.800	12.500	12.000
10	35.700	35.475	91.125	15.000	14.800	12.500	12.000
11	35.700	35.775	91.375	15.000	14.800	12.500	12.000
12	35.700	36.175	91.500	15.000	14.800	12.500	12.000
13	35.700	36.200	91.500	15.000	14.800	12.500	12.000
14	No Market	37.150	91.500	15.000	14.800	12.500	12.000
16	35.700	36.075	91.500	15.000	14.800	12.500	12.000
17	35.700	36.225	91.375	15.000	14.800	12.500	12.000
18	35.700	35.800	91.375	15.000	14.800	12.500	12.000
19	35.700	36.400	91.500	15.000	14.800	12.500	12.000
20	35.700	35.550	91.875	15.000	14.800	12.500	12.000
21	No Market	36.125	91.750	15.000	14.800	12.500	12.000
23	35.700	36.150	91.375	15.000	14.800	12.500	12.000
24	35.700	36.300	91.500	15.000	14.800	12.500	12.000
25	35.700	35.825	91.750	15.000	14.800	12.500	12.000
26	35.700	36.050	91.750	15.000	14.800	12.500	12.000
27	35.700	36.700	91.625	15.000	14.800	12.500	12.000
28	No Market	36.700	91.625	15.000	14.800	12.500	12.000
30	Holiday	36.625	Holiday	Holiday	Holiday	Holiday	Holiday
31	35.700	37.225	91.500	15.000	14.800	12.500	12.000
AVERAGES FOR MONTH							
May	35.700	36.187	91.380	15.000	14.800	12.500	12.000
AVERAGES FOR WEEK							
May							
4	35.700	36.325	91.188	15.000	14.800	12.500	12.000
11	35.700	35.788	91.021	15.000	14.800	12.500	12.000
18	35.700	36.271	91.458	15.000	14.800	12.500	12.000
25	35.700	36.058	91.625	15.000	14.800	12.500	12.000
CALENDAR WEEK AVERAGES							
May							
7	35.700	36.125	90.979	15.000	14.800	12.500	12.000
14	35.700	36.058	91.354	15.000	14.800	12.500	12.000
21	35.700	36.029	91.563	15.000	14.800	12.500	12.000
28	35.700	36.288	91.604	15.000	14.800	12.500	12.000

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries: tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.50c.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

May 1955	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
2	279.9062	87.000	75.500d.	250s. 5¼d.	$35.00
3	279.9508	87.000	75.500d.	250s. 5¼d.	35.00
4	279.9776	87.000	75.500d.	250s. 5d.	35.00
5	279.8883	87.000	75.500d.	250s. 5d.	35.00
6	279.8541	87.000	75.500d.	250s. 6d.	35.00
7	(e)	(e)	(e)	(e)	35.00
9	279.8593	87.000	76.000d.	250s. 5¼d.	35.00
10	279.8125	87.000	76.250d.	250s. 5¼d.	35.00
11	279.5803	88.500	76.250d.	250s. 6¼d.	35.00
12	279.6339	88.500	77.250d.	250s. 7¼d.	35.00
13	279.7008	89.750	77.250d.	250s. 8¼d.	35.00
14	(e)	(e)	(e)	(e)	35.00
16	279.7901	89.750	78.250d.	250s. 6d.	35.00
17	279.5937	89.750	78.125d.	250s. 7d.	35.00
18	279.5803	90.160	78.000d.	250s. 8¼d.	35.00
19	279.4062	90.160	78.000d.	250s. 9d.	35.00
20	279.0312	90.160	78.000d.	251s. 0d.	35.00
21	(e)	(e)	(e)	(e)	35.00
23	279.2500	90.250	78.125d.	251s. 2¼d.	35.00
24	279.3616	90.250	78.500d.	250s. 11d.	35.00
25	279.2455	90.250	78.500d.	250s. 11d.	35.00
26	279.2946	90.250	78.500d.	250s. 11d.	35.00
27	279.3973	90.250	78.500d.	250s. 9½d.	35.00
28	(e)	(e)	(e)	(e)	35.00
30	Holiday	Holiday	Holiday	Holiday	Holiday
31	279.2276	90.500	78.500d.	250s. 11¼d.	35.00
AVERAGES FOR MONTH					
May	279.588	88.928	77.214	—	35.00
AVERAGES FOR WEEK					
May					
4	279.885	87.000	—	—	—
11	279.799	87.300	—	—	—
18	279.660	89.582	—	—	—
25	279.259	90.214	—	—	—

Calendar Week Averages: New York Silver: May 7th, 87.000; 14th, 88.150; 21st, 89.996; 28th, 90.250.

(e) No Market (Saturday)

Trends and Prices

London Metal Exchange Quotations

	COPPER				LEAD				ZINC				TIN			
	Cash		3 Mo.		Current Month		3 Mo.		Current Month		3 Mo.		Cash		3 Mo.	
May	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
2	304	305	293	293½	103⅝	103½	103½	103⅝	88½	88¾	87½	87¾	709	710	712½	713
3	302½	303	291½	292	103½	103½	103½	103½	88½	88¾	87½	87½	709½	710	712½	713
4	302	303	290	291	102¾	102½	102½	102¾	88¼	88½	87¼	87½	708½	709½	713	713½
5	305½	306½	291½	292	103	103¼	103	103¼	88½	88¾	87½	87¾	710½	711	714	714½
6	306½	307	293	293½	103	103¼	103	103¼	88¾	89	87¾	88	708½	709	712	712½
9	301	302	289	289½	102½	102¾	102¾	103	88¾	89¼	87½	87¾	714	715	717	718
10	303	305	290	291	102¾	102½	102½	102¾	89¼	89½	88	88¼	711	712	713½	714½
11	304½	305½	291½	292	102¼	102½	102½	102¾	89	89½	87¾	88	711	712	714	714½
12	312	313	297½	298	102¾	103	103	103¼	89½	89¾	88¼	88½	714	714½	715	717
13	321	322	303	304	103½	103¾	103½	103¾	89¾	90	88¼	88½	716½	717	718	719
16	321	322	304	305	103½	103¾	103½	103¾	89½	89¾	88	88½	713	714	715½	716
17	325½	326	307	307½	103¼	103½	103	103¼	89½	89½	88	88½	711	713	714	714½
18	324	326	306	308	103	103¼	102¾	103	89¼	89¾	88	88¼	712½	713½	714½	715½
19	334½	335	314½	315	103	103¼	102¾	102¾	89¾	90	88¼	88½	714	714½	716½	717
20	323	324	303½	304	103	103¼	102½	102¾	89¾	90	88½	88½	714	715	716½	717½
23	328	329	308½	309	103¾	104	103	103½	90	90¼	88½	88¾	714½	715	717	718
24	334½	335	316	316½	103½	104	103	103½	90½	90½	88¾	89	713½	714	716	717
25	331	333	314	314½	103¼	103½	103	103¼	90½	90¾	88¾	89	714½	715	717	717½
26	330	331	317	317½	103¼	103½	102¾	103	90½	91	88¾	89¼	715½	716	717½	718
27	332	334	320	321	102½	103	102½	102¾	91	91¼	89	89¼	716½	717	717½	718
30	Holiday															
31	332	334	321	322	103¼	103¾	102⅝	102⅝	91½	91¾	89¼	89½	719	720	719½	720
Av'g's	£318.536		£303.286		£103.173		£103.000		£89.685		£88.250		£713.274		£715.750	

Prices are for the official a.m. session in pounds sterling per ton. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted.

MISCELLANEOUS METALS

May 31, 1955

Aluminum ingot, 99 plus % lb			23.2¢
Antimony, spot, lb, less than carload, in cases			31.97¢
In bulk, carload lots, f.o.b. Laredo			28.50¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb, contract			$1.18
Cobalt, 9 to 99%, per lb			$2.60
Germanium, lb			$295.00
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	@	$12.00
Nickel, cathodes, lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Freeport, Texas			28½¢
Palladium, troy oz	$19.50	@	$20
Platinum (wholesale lots) troy oz	$76.00	@	$79.00
Quicksilver, flask of 76 lb, 25 flasks or more	$295	@	$298
Selenium, 99 plus %, lb	(b)$6.00	@	$7.25
Silicon, minimum 97%, carloads, lb			18¢
Tellurium, lb			$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A, max. 3% iron, lb			$3.95

(a)Includes U. S. duty. (b)Depending on quantity.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$38.00	@	$40.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$22.00	@	$23.00
48% Cr_2O_3 3 to 1 ratio	$43.00	@	$46.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$10.50
Mesabi bessemer			$10.25
Mesabi, non-bessemer			$10.10
Lead (Galena), 80%, Joplin, Mo., ton			$187.85
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties 88 @ 90¢ c.i.f. U. S. ports, duty extra. Long-term contract nominal at 88 @ 90¢ c.i.f. duty extra.			
Molybdenum Ore, 90%, per lb of Mo f.o.b. mines			$1.05
Columbium-Tantalum, per lb, combined oxides			(a) $3.40
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$32.50	@	$33.00
Domestic, scheelite, 60% f.o.b. mill			$63.00
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$72.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb, in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.97½
Copper Sulphate, 100 lb			$12.25
Germanium Oxide, lb			$142.00
Molybdic trioxide, technical, per lb of Mo	$1.24	@	$1.25

ALLOYS

Ferrochrome 65 to 69%, per lb of Cr. contained			24½¢
Ferromanganese, 74–76%, net ton, seaboard			$190
Ferromolybdenum, 55 to 65% Mo, lb of Mo contained	$1.49	@	$1.57
Ferrosilicon, 50% per lb of contained Si			12¢
Ferrotungsten, 72 to 82%, lb of W contained			$3.38
Ferrovanadium, per lb of C delivered	$3.00	@	$3.25
Silicomanganese, max. 1½% carbon, lb, contracts			11.4¢
Spiegeleisen, per long ton, 19 @ 21% grade			$86.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$960	@	$1,500
Crude No. 2	$595	@	$900
Spinning fibers	$321	@	$514
Shingle fibers	$150	@	$200
Paper stock	$109	@	$137
Waste			$77
Shorts	$35	@	$70
Asbestos, f.o.b. Vancouver, B. C. (U. S. funds):			
Spinning fiber, 3-K			$460
Shingle fiber, 4-K			$185
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$279.50	@	$302.00
Shingle stock	$135.00	@	$162.00
Paper stock	$81.50	@	$115.00
Waste, stucco or plaster			$71.40
Refuse or Shorts	$34.00	@	$63.00
Barytes f.o.b. cars:			
Georgia, crude, per ton			$15.00
Missouri, 94% $BaSO_4$, per short ton			$13.25
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$29.00	@	$30.00
60% effective CaF_2	$26.00	@	$27.00
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$38.00

Mica—Domestic, f.o.b. mines. Punch 12 to 22¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to 85¢; 2 x 2 inch, $1.10 to $1.60; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap $25 and up.

Ocher, Georgia, ton, in sacks	$26.50	@	$30.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, Texas, mines, long ton	$25.50	@	$27.50
Talc, f.o.b. works ton			
New York, purified	$18.50	@	$20.00
Vermont, extra white			$13.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$30.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$56.00
Steel f.o.b. Pittsburgh, billets, net ton			$64.00
Structural shapes, Pa., Ala. etc., 100 lb			$4.25

New Law Cheers Chilean Copper Miners

Leading Producers Will Operate In Better Economic Climate; Some Expansion Planned

CURRENT ACTIVITY now centers around Kennecott's El Teniente; Anaconda's La Africana, located near Santiago, Chuquicamata mine, and exploration at Indio Muerto. Sagasco is exploring near Iquique.

NEW CHILEAN COPPER BILL, passed in early May by the legislature and backed by President Carlos Ibanez, has received almost unanimous approval from responsible sources, in government and among members of the opposition.

Under the new law, leading producers in Chile operate in an improved economic climate and, in turn, plan expanded production and increased output.

Principal changes affecting the major copper producers:

1. Companies will now keep the full sale price for their copper. Under previous laws, they got a maximum of 24½c per lb, no matter how much higher the actual price went.

2. Taxes are altered from previous 60% of profits (difference between mining costs and 24½c per lb) to a basic 50% tax plus a 25% surtax. Surtax is tied to production levels: for each 1% increase over the base average, surtax is decreased one-eighth. "Base average" is 95% of the individual companies' production in the years 1949-1953.

3. Exchange rate is now at the free banking rate—200 pesos to the dollar at present—rather than the discriminatory rates formerly applied. Last year's rate averaged around 70 pesos to the dollar for the major companies.

4. Control of sales is now in the hands of the producers, not under the Mining Bank, former vendor. Law sets up a Copper Department, (11 members, 9 chosen by the government) to which producers report all sales and pertinent data. If Department feels that sales made are not in the "national interest", it retains the right to act for the producers, receive offers and order sales.

Principal producers in Chile had already begun expansion of various properties prior to the enactment of the new law. Some of the current plans include:

1. Production of about 21,000 tons per month of copper by treating more tonnage of ore at Chile Exploration Co.'s Chuquicamata open pit;

2. Investment of $1½-million in building a mill, sinking a new shaft and equipping the Africana mine of Santiago Mining Co.;

3. Accelerated exploratory operations at Andes Copper's Indio Muerto deposit. Andes' Potrerillos mine is reported only good for another 6 to 7 years unless facilities are introduced to exploit lower grade ores there.

4. Expansion to the tune of $3-million at Braden Copper's El Teniente mill, where capacity is already up to 13,000 short tons of fire-refined copper per month. Notable in the agreement with Braden is the government's decision to authorize the company to depreciate its new installations within a period of five years, one of the first such authorizations known in Chilean negotiation.

5. Compania Cuprifera Sagasco, S.A., is reported to have reached agreement with the government to open up deposits near Iquique, in the north, and invest $3-million. Sagasco is owned by United Satamin Mining Co. of Canada.

Anglo American Corp. Will Sink Four New Shafts in Free State

MAJOR SHAFT-SINKING PROGRAM is being started at Anglo American Corporation of South Africa Ltd.'s Welkom Group of gold mines in the Orange Free State.

Program involves four new shafts; at Welkom G. M.'s property, President Brand, Western Holdings and St. Helena. All will eventually require increased mill capacity at each operation.

Welkom G. M. will sink twin circular shafts, 150 ft apart, in the southwest corner of its property. New shafts will allow opening of a rich section which can not now be reached because of a 2,000 ft downthrow fault. Welkom plans mill expansion to 150,000 tons per month.

President Steyn G. M. Co. Ltd., Welkom's neighbor, will use the twin shafts to improve ventilation at its own workings. Reduction plant will also be stepped up.

President Brand will also get assistance from the Welkom shafts and will sink two subvertical shafts of its own No. 2 shaft to a depth of 7,250 ft. No. 2 will be downcast; existing No. 1 will be upcast for the whole mine and Brand will

Mining Calendar

Four Corners Geological Society, field conference, June 15-17, Paradox Salt Basin.

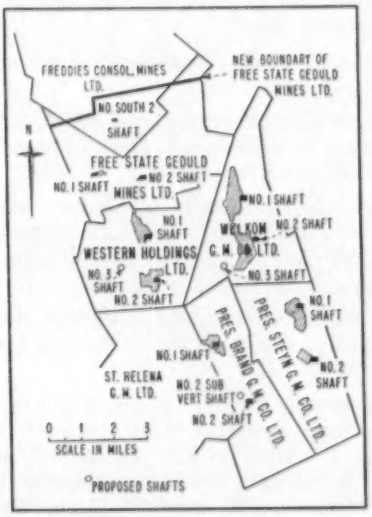
AIME Rocky Mountain Minerals Conference and fall meeting of MBD, October 5-8, Salt Lake City.

American Mining Congress 1955 Metal Mining and Industrial Minerals Convention, October 10-13, Las Vegas, Nev.

use Welkom's shafts for downcast. Milling rate is expected to increase to about 100,000 per month.

Western Holdings will also sink twin verticals, slightly west of existing shafts. Proposed depth of 4200 ft is expected to improve ventilation and allow opening of deeper levels. Mill capacity is being stepped up to 125,000 tons per month with future expansion to 150,000.

St. Helena Mine will open up its northeastern section with a vertical shaft which is expected to intersect the reef at 4,000 ft. Ultimate depth will be 5500 ft; mill capacity will be upped to 150,000 tons per month.



PROPOSED SHAFTS at Welkom, Western Holdings, St. Helena (not shown), and President Brand will call for expanded capacity at all mills. Hatched areas show extent and direction of underground development to Dec. 31, 1954. New boundary of Free State Geduld results from purchase from Freddies Consolidated Mines of No. 2 south shaft and 1300 claims.

Wah Chang Joins USBM In Titanium Research

U. S. BUREAU OF MINES and Wah Chang Corp. have entered into a cooperative agreement to conduct research and development on reduction of titanium sponge at the Government's Boulder City, Nev., experimental station.

Thomas F. Moran, executive vice president of Wah Chang, noted that his company's research activity, started in 1950, encouraged further pilot work. "We feel," he said, "that the future of titanium warrants . . . an investment in research over and above what the company has already invested in its development." Wah Chang's contribution will be about $600,000 per year.

(*Continued on p 120*)

As we went to press....

St. Joseph Lead Co. and Pittsburgh Consolidation Coal Co. have proposed construction of an $85-million primary aluminum producing plant to ODM. Plant would add 66,000 tons per year to U. S. output and would be powered by coal. Plans are "completely embryonic," according to G. H. Love, Pitt Consol president. Outcome depends upon various studies now underway by the proposing companies and government approval of a certificate of necessity.

Decision has been reached to mine sulphur deposit under the waters of the Gulf of Mexico by Freeport Sulphur Co. Ore is located at Lake Pelto, near Freeport's Bay Ste. Elaine, and is the first company property found completely under water.

Billiton Tin Co., in annual report, noted that Indonesia was second in production of tin last year. Company is moving toward diversification with 70% share in Mbeye Exploration Co., Tanganyika; majority interest in French Moroccan firm; majority share in Kalativi Tin Mines, Southern Rhodesia; and exploration in Canada and elsewhere.

Rio Tinto says it will drill for uranium near Darwin, where rock structure was found resembling Canada's Algoman beds.

American Sulphur & Refining Co., Beverly Hills, Calif., has put its 100-tpd refinery at Sulphurdale on stream. "Solvent recovery" method of extraction involves leach-precipitation technique "made possible by specially designed equipment and controls."

Western Potash Corp. has completed $17.5-million financing program for production from potash reserves in the Unity area of Saskatchewan. Core drilling on the 120,000-acre site blocked out a reported 60-million tons of potash ore. Minimum production rate is an expected 1,000 tpd finished product. Program is planned to start in July with initial construction.

In this issue . . . .

Anaconda's Con Kelley resigns as board chairman. p 120

DMEA uranium applications top previous records. p 122

Inland Steel starts 5-year nonstop dredge job. p 122

U&I Uranium merger with Odlum's Federal. p 142

Steamer "Calcite" opens Port Dolomite on Great Lakes. p 148

New Jersey iron mines will reopen. p 152

Morocco's phosphate production soars. p 198

Annual reports of leading mining companies. p 190

Behind the By-Lines . . .

G. P. Lutjen

Big news this month is right on the cover. It's a portrait of the domestic uranium industry as it stands today. Perhaps it should be captioned "View of uranium industry looking up." Whatever we call it, it's news because it's the first time that the status of the industry has been pictured anywhere. The chart was prepared by the Division of Raw Materials of the AEC largely as a result of some conversation with Carroll Wilson on the uranium milling situation, reported in *E&MJ* last month. And a pretty picture isn't all that is being offered to clear up what was fast becoming a pretty mixed-up situation. Starting on the page across the way, you will find further insight into the problem by men who know whereof they speak.

Frank talk is a real menace at a dinner party but it can be a real boon for the technical man who wants some straight answers. This issue sports a good deal of frank talk not the least of which comes from Harlowe Hardinge in an article on autogenous grinding (See p. 84). We quote: "Our experience has now spanned a period of nearly one-half a century and has been very costly to us to date to say the least."

This is typical of the candid remarks which make the article such stimulating reading. The lessons learned at each step in the development of a mill for making rock grind itself are profitable reading for mill men everywhere. But why don't you let the facts speak for themselves.

Do you have an idea for a new missile? Or a new principle which might revolutionize aircraft design? Or a new material which can stand temperatures that turn ordinary metals to liquid?

If you do, it's our patriotic duty to tell you that the Air Research and Development Command would like to see your ideas and test them. As a matter of fact they've just appointed an Assistant for Innovations to take care of innovators and their innovations. After innovating you can contact him at Box 1395, Baltimore 3, Md. It's the office right next to the Assistant Deputy for Consternation.

We can't help them revolutionize aircraft design, but we can tip them off to a nine-year-old in our neighborhood who has developed a slingshot that has frightening possibilities.

We're infringing on the New Products section of the book but we think you really ought to know about the Model 2-B Regrettor which was recently called to our attention. To quote from the manual which presumably is supplied with the instrument, the No. 2-B Regrettor is a "Light weight, compact unit, recently developed for use by persons whose capacities for regretting are below normal, or who, due to various activities, have more to regret than can be conveniently handled without artificial aid.

"Through use of this device it is possible for the user to have his bad moments regretted for him, and he is meanwhile left free to engage in activities which may be regretted later."

Here are some of the outstanding features of the unit:

By means of a simple change-over switch, the No. 2-B regrettor can be made to rue. Days, of course are the least difficult of all items to rue.

Response of the Regrettor is substantially uniform over the entire sad gamut of emotional range being less than 2 db down at the perfunctory regret end and 3 db down at the black despair end.

Where a flatter characteristic is desired, the Regrettor may be flattered with a Type 22 False Praise Lavisher.

According to tests to destruction in which the Republican party Inc. cooperated, the Regrettor will withstand excessive overloads for long periods. While regretting for the Republicans the test unit operated under conditions of almost 90% overload continuously for 6 months without failure. When failure occurred it was directly traceable to an abnormally high concentration of hot gases and cigar smoke which interfered seriously with proper ventilation.

More information on this remarkable machine quite possibly may be obtained by contacting Harry E. Hershey whose article in the 6th edition of *Automatic Telephone Practice* alerted us to its possibilities.

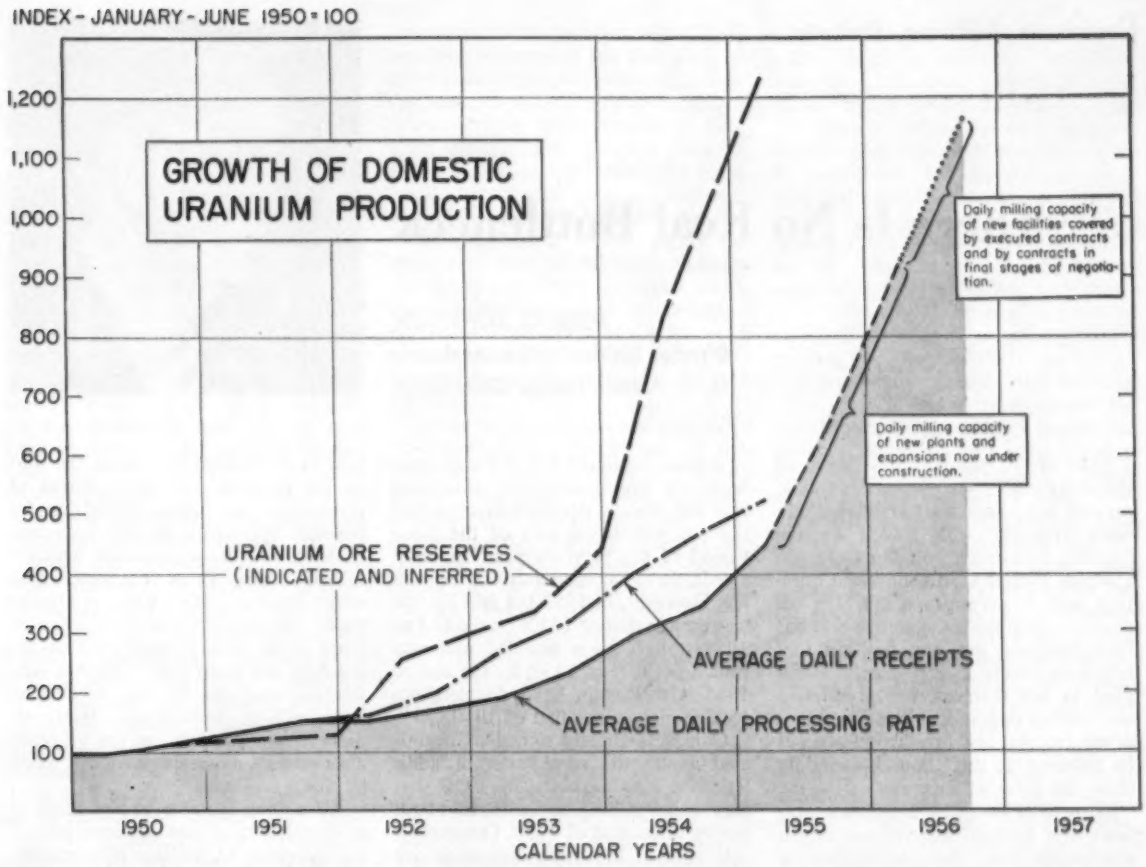
For your file of Opening Gambits, Conversational we submit the following three items to which the replies are respectively "Gosh!", "Oh?," and "So What!"

(a) Steel industry in the United States requires six-million gallons of water every minute.

(b) According to the Bureau of Indian Affairs the country's heaviest concentration of Indian population is in New York City where there are 181.8 Indians per square mile. And that 0.8 Indian is probably in pretty bad shape.

(c) Another uranium merger looming that is out of this world—Planet Uranium, Inc., and Globe Uranium Inc., are expected to affiliate with Lone Star Mining Development Co.

With material like this why should we work our head to the bone?



ORE RECEIVED AND ORE MILLED is calculated on the basis of average daily tonnage for each six-months' period, with daily average for January-June 1950 designated as 100. Ore receipts and ore milled in the base period were approximately in balance. At the time this chart was drawn, expressly as a contribution to information on uranium milling on the Plateau, other mill contracts were in negotiation, between AEC and industry representatives.

Uranium Men Reveal Insight and Information in Milling Policy Debate

PROBABLY THE MOST REVEALING LOOK at the status of the domestic uranium mining industry ever available to mining men or anyone else, lies in the self explanatory chart above. Why it has been made available at this time is significant.

Last month on these pages, we recorded an interview with Carroll Wilson, vice-president and general manager of Metals and Controls Corp., Attleboro, Mass. Formerly general manager of the Atomic Energy Commission and later, president of Climax Uranium Co., Mr. Wilson offered a penetrating analysis of the domestic uranium milling program.

This effort on the part of Mr. Wilson and *E&MJ* was frankly exploratory. Thanks to Mr. Wilson, however, for the first time in print, salient problems of the uranium milling industry were clearly defined. To this was added a well thought-out suggestion for solution to the problems.

To promote discussion of this important issue, to bring to light more facts, to examine more closely all sides of this complex subject, we sent advance copies of the interview to a number of people close to the uranium industry—individuals, company officials, officers or associations whose interests are closely identified with the industry, and the AEC.

Information and thoughtful examination were soon forthcoming. Jesse Johnson, Director of AEC's Division of Raw Materials, contributed an important glimpse of the AEC's progress, not only in milling but on ore production in general. The chart above has tremendous significance—but that is Mr. Johnson's story and he tells it ably on the next few pages.

Nor was the AEC the only quarter heard from. Blair Burwell, one of the most capable metallurgists on the Plateau, has delivered a careful analysis of economical-metallurgical aspects of the milling problem. Robert Palmer, widely known executive vice president of the Colorado Mining Association, has crystallized the thinking of the small mine operators and prospectors.

You'll find provocative reading on the next few pages which should be of considerable help in weighing the situation for yourself.

Discussion starts on next page.

There Is No Real Bottleneck

JESSE C. JOHNSON
Director Division of Raw Materials
U. S. Atomic Energy Commission

I HAVE BEEN ASKED by the Editor of the *Engineering & Mining Journal* to present my views on Carroll L. Wilson's interview with *E&MJ* on the "milling bottleneck" on the Colorado Plateau. Rather than follow the question and answer procedure, I shall endeavor to outline the course that has been followed and the position that has been reached, particularly in regard to ore reserves, ore production and milling operations. Since tonnages of ore reserves and production can not be released at this time, I can only show the rates of increase.

Growth of domestic uranium operations over the past five years is shown graphically on the accompanying chart. The first six months of 1950 is used as a base period for operations as, by that time, the domestic program had been in effect for two years and ore production and ore processing were about in balance. Also, by 1950 we had reasonably good information on ore reserves. Because at that time most of the ore production was coming from small deposits, ore reserve data may not have given an entirely accurate picture. Many of the small producing mines, which on the whole were making a rather substantial contribution to the ore supply, had no measurable reserves. Today the relative importance of such production has been greatly reduced because over 80% of known reserves are in deposits containing 50,000 tons or more. These deposits now account for a major part of the ore being mined.

It will be seen from the chart that about the middle of 1952 ore production began to increase faster than the milling rate but in 1953 the rates of increase became nearly parallel. With completion of facilities now under construction, the milling rate by the end of 1955 may be equal to ore production, taking into consideration the large expansion of mining operations now planned. However, stockpiles may be increasing in some areas while decreasing in others.

Although milling has not kept pace with ore production, the processing rate has always equalled or exceeded the ore production rate of the same period of the previous year. In other words, there has been a twelve month's lag. However, in 1953 the milling rate was double that of 1950; by the end of 1954 it had again doubled and was four times that of 1950; by the end of 1955 it will again have doubled, becoming eight times that of 1950.

Contracts already signed or negotiated assure the completion of additional milling capacity in 1956 that may raise milling capacity to about twelve times that of 1950. Other projects now in the discussion stage are likely to be under construction before the end of 1955 and completed in 1956. These projects have not been included in the projection shown on the chart. In making the projections, new facilities under construction and under contract are estimated to reach rated capacity three months after completion.

The sharp increase in ore reserves beginning about the end of 1953 was due in a large measure to two outstanding discoveries made near the end of 1952 and to the subsequent intensive development of the surrounding areas. One is the discovery made by the Anaconda Copper Mining Co. in the Laguna Indian Reservation, N. M., and the other is the Charles Steen discovery in the Big Indian Wash, Lisbon Valley District, Utah. Because of the time required for development, it was nearly twelve months before ore reserves began to increase with great rapidity.

Planning of mill facilities was difficult. Anaconda, for example, which has an integrated operation, has endeavored to provide milling capacity commensurate with ore reserves. In the last year and a half, five mill expansions were agreed upon and in two instances upward revisions were made before construction started.

Exploration and development are now at the highest level since the start of the program and new sources of production are being opened up far beyond the limits of the Colorado Plateau. Recent developments indicate that Wyoming, Texas and Washington may become important producing states. Development is also active in other areas. The program still is expanding and there will be further substantial increases in ore production and milling operations. However, there is no evidence as yet of other discoveries comparable to those made by Steen and Anaconda.

All milling facilities except those at Monticello, Utah, are privately owned and operated. Many large mining companies and several important chemical companies are interested in uranium ore processing. A number are actively scouting for opportunities. Private industry has been ready to finance the construction and operation of new mills and to expand existing plants whenever there was an adequate supply of ore. There is no basis for the statement that there is a "milling bottleneck" because of the lack of profit incentives. However, neither private industry nor the Commission is prepared to build a mill unless there is a reasonable assurance of enough ore to support the milling operation over the period of a contract.

Why then are there large stockpiles of ore and why has mill construction not kept pace with ore production?

The principal reason is that the Commission endeavors to provide the uranium miners with a market for ore in advance of the construction of milling facilities. Because of the nature of the Colorado Plateau uranium deposits, mining operations often commence within a few months after discovery and before there is information on which to estimate ore reserves. Mill construction takes at least twelve months. Prior to construction, the milling company must make its investigations, study the metallurgy, estimate operating and capital costs,

negotiate a contract with the Commission and design the plant. During this period the Commission may be purchasing and stockpiling ore at the proposed mill site. Under a procedure of this kind, stockpiles of ore are inevitable and the size of the stockpiles are related to the size of the new mining operations.

The Commission's ore buying program was established in early 1948 in an attempt to develop domestic uranium production. It was undertaken to meet an urgent national defense requirement and probably no mineral development program ever was considered more important. At that time we had practically no uranium production, known reserves were limited and these were contained in small scattered deposits. On the basis of our geological information, the success of the program depended upon the discovery and development of many more such deposits with only a hope of finding some large orebodies.

Consequently, the program was designed to encourage widespread prospecting and mining of small deposits. If we had the ore, wherever it might be found, milling facilities could be provided, even if they had to be financed by the Government. Therefore, guaranteed minimum ore prices were established, together with haulage allowances, initial production bonuses and other incentives. It has been the policy of the Commission to furnish a market for all ore delivered to buying stations, subject only to the capacity of the facilities, and to set up local buying stations whenever warranted by the production potentialities of a new area.

As Mr. Wilson points out, the Commission's ore buying schedule provides that no producer may deliver in excess of 1,000 tons in any year without a contract. This provision was not for the purpose of restricting ore production but to provide for orderly delivery schedules and planned production rates. There are no penalties for failure to deliver except cancellation of the contract. If the ore available for delivery in an area exceeds the capacity of the installed sampling facilities, deliveries must be limited until the facilities can be expanded. This the Commission has endeavored to do as soon as possible.

Mr. Wilson suggests that the Commission might limit ore purchases to the 1,000-ton non-contract commitment in order "to move private property owners into getting a partnership with a milling outfit, or with milling capital." This would be evasion, under a technicality, of the Commission's assurances to the miners.

Mr. Wilson states that the art of uranium metallurgy "is at a very primitive stage at the present time." That was true seven years ago and some of the earlier plants still are using modified older processes. However, major advances and developments in uranium metallurgy have taken place as a result of laboratory and pilot plant work by the Commission and cooperative programs in the United States and foreign countries. Newer plants recover over 90% of the uranium from low grade ores. New processes to be used in mills now under construction will recover over 97% of the dissolved uranium directly from the pulp without filtering or the need of a clarified solution.

Some of the large uranium mills now have among the lowest per ton operating costs in the hydro-metallurgical industry. Further advances will be made and new processes will be developed, but from now on the rewards in terms of lower costs and improved recoveries are likely to be small. However, new types of uranium-bearing materials, such as lignites, for example, may present problems requiring the development of entirely new process steps.

The various metallurgical processes in use on the Colorado Plateau also have an effect upon the accumulation of ore. Mills using the older processes for recovering both uranium and vanadium require a pregnant solution with a definite uranium-vanadium content. These mills can not operate economically on non-vanadium or low vanadium ores. None of these have excessive stockpiles. However, over 50% of the domestic uranium ores are now in the low vanadium class. The large stockpiles today are at mills which have just been completed or are at locations where mills are under construction or planned. The one exception is the Commission's mill at Monticello, Utah. This mill has been accepting the ores that could not be treated elsewhere. It has taken time to develop a process that could handle successfully a heterogeneous mixture of ores. With the completion this year of the major expansion program now under construction, this mill should be able to process efficiently nearly every type of ore and mixture of ore.

Time required for developing information for contract negotiation has been greatly reduced by the availability of the Commission's large, modern pilot plant at Grand Junction, Colo. Prospective milling contractors may use these facilities for determining metallurgical, cost and mill design data. Without such facilities each prospective contractor might have to construct his own pilot plant. Before making a commitment for a uranium mill costing several million dollars, a private company without previous experience in uranium processing would certainly check metallurgical and cost data by pilot scale operations conducted by its own organization. The Commission also makes available metallurgical data developed by it and its contractors but the milling company naturally makes the decision as to the process and the plant design. However, the operating costs accepted by the Commission as a basis for negotiation must be in line with those of a comparable efficient operation using the most effective applicable process.

It has been suggested that a uniform price for uranium concentrate be established. When uranium becomes a commercial product its market value undoubtedly will be expressed in terms of a concentrate or metal price. This price will be determined by supply and demand. It will be desirable for the Commission to plan its uranium procurement program so as to provide for an easy transition to a commercial market. However, it does not appear practical for the Commission to establish a uniform concentrate price which would run concurrently with its present ore buying schedule.

Under the Commission's ore buying schedule the price per pound of U_3O_8 contained in ore including development allowance, varies with the grade, ranging from $2.00 per lb for 0.1% U_3O_8 ore to $4.00 per lb for 0.2% ore, with premiums for higher grade. This price schedule was designed to make it economical to mine and ship low-grade ores from deposits of reasonable size. In a sense, there is a subsidy for low-grade ore because the cost of producing a concentrate from such ore is higher than that for concentrate produced from high grade ore. Haulage allowance of 6c per ton mile up to 100 miles still further increases the difference in cost. As a result, concentrate price paid to mills under our negotiated contracts varies with the average grade of the mill heads. Consequently, we can have no uniform concentrate price without making it more advantageous for the mills to purchase, as far as possible, only high grade ore. If the concentrate price provided a reasonable profit for processing low grade ore, the profit would be excessive for high grade ore. If the price was based upon treatment of high grade ore, there would be no market, except with the Commission, for low grade ore.

Another problem is the variation in milling cost. Operating costs have been reduced and metallurgical recoveries increased as a result of new processes developed and introduced by the Commission during the past few years. With these rapid changes in milling practice, and with a program

demanding maximum uranium production, it has not been possible to modernize fully all the older mills or to replace any of them. Since the Government is the sole buyer of uranium, industry must have a relatively long term guaranteed price in order to justify substantial expenditures for exploration, mine development and mill construction. Any long term concentrate price established by the Commission must be based upon efficient operations using the most effective existing processes. With such a concentrate price some of the existing mills would have to close unless they could negotiate contracts with higher prices. A somewhat similar situation existed during World War II and the Korean War in the case of other metals. To obtain maximum production, Government agencies subsidized certain high cost mining and milling operations.

If the Commission's program had been set up on the basis of a concentrate price rather than an ore buying schedule, there would not have been the rapid development of domestic uranium production. Miners and prospectors would not have been able to translate a concentrate price into an ore price. With a concentrate price schedule the mills would have set the ore price. There were only two companies in the field with experience in processing Colorado Plateau ores and metallurgical processes were designed primarily for recovery of vanadium. The market for uranium ore would have been limited by mill capacity and in the new areas, ore production would have had to await development of sufficient reserves to justify mill construction. Under such a program we would have had no surplus stockpiles of ore, but uranium production and potential production probably would be far less than it is today.

Mr. Wilson suggests a "commission" to investigate the "milling bottleneck." Considering the expansion of ore processing operations as pointed out above and shown graphically on the attached chart, Mr. Wilson's reasons for such a commission appear invalid.

Our Commission has had an Advisory Committee on Raw Materials since the start of the program. Members of this committee have been prominent professionally in the fields of geology, mining and metallurgy. The functions of this committee have included the type of studies suggested for Mr. Wilson's "commission." A list of those who have served on the Raw Materials Advisory Committee since 1947 appears at the right.

Vanadium Is One of the Big Problems

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IT IS DIFFICULT TO COMMENT adequately on the subject of uranium processing on the Colorado Plateau and the "bottleneck" in milling operations discussed by Carroll Wilson, without first briefly considering the economic background of the region and the metallurgy of the various ores. This subject can be lengthy and involved, but I will attempt to cover the basic essentials briefly.

One basic problem that enters into the economics of the situation and the metallurgy of the ores is that the ores of the region contain widely varying amounts of vanadium. Much of the plant facilities and accompanying plant investment in at least five of the eight plants of the region have been installed for the recovery of vanadium in the period when the recovery of this metal was a major and profitable business. This region has been and is one of the largest vanadium producing areas in the world, with a recorded production of more than 40% of world totals, and much of the present metallurgy and price schedules have evolved from the economics and interests of vanadium plants.

Uranium recovery units have been added to these plants treating tailings from the vanadium roasting steps. Capital investment in vanadium recovery units are in the order of $10,000 per ton of throughput and on the auxiliary uranium facilities, about $3,000 per ton of throughput. Vanadium sales and markets in this country are almost exclusively in the hands of two companies, Union Carbide and Carbon Corp. (U.S.V.) and the Vanadium Corporation of America, and is a part of the highly integrated alloy steel business.

New venturers in the field considering installations to treat ores with substantial vanadium content for uranium recovery, have no incentive to recover co-product vanadium or to go into the vanadium business as it now exists because the largest part of the vastly increased production of vanadium resulting from processing of carnotite ores for uranium cannot now be absorbed in industry.

Although currently about 3,000,000 lb of vanadium metal finds a sale, some radical change in the marketing of vanadium is required to increase present consumption such as reducing its price to make it competitive with molybdenum in engineering steels, or research on new uses.

While there is some difference of opinion as to the proper remedy for expanding vanadium markets, it is generally agreed that vanadium has not lost its merits in tonnage steel to other alloy elements, but its price has become too high to justify its use when other alloys are available at lower cost. Result of this situation is that currently all vanadium produced on a reasonable proportion of uranium production which cannot be sold in industry at $3.00 per lb of vanadium metal (equivalent to $1.50 per lb of oxide), is sold by special arrangement of the AEC with the GSA into the stockpile. These are auxiliary contracts to vanadium producers. While stockpile figures are necessarily secret, it is

Advisory Committee on Raw Materials

**G. Temple Bridgman
Francis Cameron
*Everette L. DeGolyer
*Thorold F. Field
*Francis G. Frary
*J. K. Gustafson
Anton Gray
Ira B. Joralemon
**Wilber Judson
**Walter L. Maxson
Robert E. McConnell
Donald H. McLaughlin
Frank W. McQuiston Jr.
*Ernest H. Rose
Fred Searls Jr.
*Walter O. Snelling
*Orvil R. Whitaker
*Clyde Williams

*Present members. **Deceased.

safe to say that the present production of vanadium auxiliary to uranium has filled the stockpile far beyond any estimated or possible war requirements and actually is a direct, additional cost on uranium.

The amount of vanadium that is being absorbed by the stockpile in this manner should be considered fundamentally as a part of the cost of uranium produced from vanadium-type ores although it is not a part of AEC special contract pricing. For instance, if the cost of uranium in contracts of the AEC with a processing plant is assumed at $12, then the additional cost of over-produced vanadium will add from $3 to $5 to the Government cost.

As the majority of the ores of the Plateau contain some vanadium in greater or lesser amounts, the contractor is usually involved in this problem of vanadium disposal. For instance, there is much new ore being mined and currently stockpiled awaiting processing in the eastern Utah areas as mentioned by Mr. Wilson. These ores contain from 10 to 25 lb vanadium per ton and sufficient lime to make their treatment for vanadium a loss instead of a profit. Embedded in the ore schedules of the AEC is a price of 31c per lb of V_2O_5 contained in this ore (with some minor penalty for lime) which is the same price applied to some more fortunate mill man with a vanadium recovery mill and a subsidy contract on vanadium production. In negotiation of a contract with the AEC with this type of ore, the applicant is penalized for his sub-economic vanadium content without the advantage of an auxiliary profit. In order to equalize this difference, processing of a new type involving some measure of plant risk must be considered and the vanadium in the plant tailings wasted in solution or solid form and credited to the processing plant or purchased by the AEC. Currently, it is proposed to waste the vanadium content of these intermediate-type ores or stockpile it in a form from which ultimate recovery is questionable. The complexities and problems in the situation as well as the questions of allowable profits and risk relationships have probably been responsible for long delays in this area.

The general situation here, however, is one that the AEC inherited, and it is doing its best to work out a plan which will protect both the Government and the venturer. The answer is not easy to find.

In ores where vanadium is a cost burden and not an asset (artificially supported by the Government), it could be argued that the uranium produced from this type of ore should be at a higher price than the price given to the producer with a side profit on vanadium. The AEC apparently cannot accept this in the present pricing policy and profit limitation on new milling contracts.

In newly discovered ores where vanadium is so low as to have no influence or either economics or metallurgy, such as at Grants, N. M., there is apparently no difficulty in obtaining adequate risk capital to put up processing mills. Such ore carries little cost for unwanted vanadium and metallurgy is clear cut. Outstanding example of this is the splendidly designed and competently operated plant of Anaconda at Grants.

Vanadium production can be a burden on associated uranium or a substantial asset in reducing the cost depending upon the market position and the nature of the ores. This was the case during the war when vanadium production was carrying the cost of ore mining, transportation and 75% of milling costs at a profit. At this time uranium was produced in concentrates at 20% of the cost of the average contracts of the present AEC program.

It might be hastily assumed that the vanadium companies now have a preferred position and special profit situation not extended to new venturers. By virtue of their investments in the region and in their vanadium business, they are entitled to the same profit situation that existed before the AEC. But it is just as logical to give the new mill venturer equal profit opportunities in a competitve situation—which so far, I do not believe has been allowed.

Actually the vanadium companies were well aware prior to 1947 of the necessity, in the public interest, of developing a policy, processes and plant installations in the Colorado Plateau to meet the need of producing uranium as a primary operation and divorced from vanadium production. In 1944 before the AEC was created, a sum in excess of $400,000 was spent in Grand Junction in pilot plant work under direction of the U. S. Vanadium Corp. to develop process applications which would make it possible to produce uranium separately from vanadium. However, this project was somehow lost or forgotten between 1945 when the Manhattan District operations stopped and 1947 when the AEC started the present program. Strange things happen in Government and this is one of them. The 1947 policy as announced by the AEC in Denver stated:

1948 "Following the war it was tentatively decided to purchase only by-product uranium rather than to stimulate and support increased production by special incentives. This position was based on the fact that the known uranium reserves of the Colorado Plateau were limited and expensive to mine and process and that the only advantage of an accelerated program would be small in relation to total U. S. requirements and to supplies available from foreign sources, it appeared more economical to obtain the uranium as a by-product from vanadium operations which were geared to the vanadium market."

Returning to metallurgical considerations, it may be generalized that processing ores for vanadium by salt roasting prepares the ore, in the form of calcines, for a relatively easy separation of solids and uranium bearing liquor. The reason for this is the roasting step destroys the slime-like character of the ores and allows leaching by percolation. When the vanadium-bearing ore is of a type or content which does not justify roasting, then the separation or filtration of solvent acid or alkali liquor from the solids often becomes difficult. So far no process sufficiently plant tested to eliminate process risk has been developed for a number of these ores.

It is on this problem that most of the regional research is concentrated.

Unquestionably the building of new mills has been delayed by the complexities of the situation, risk processing and profit limitation policies of the AEC. The situation has no easy solution and whether or not a fact finding commission would be able to do more than generalize about the problem is a question. The simple solution would be a fixed uranium price with no vanadium subsidies with a price lower than the present uranium plus subsidy cost, and higher than the uranium price without subsidy.

This would probably force vanadium to solve its own market problem (which it must eventually do) and greatly stimulate plant construction by concerns who know this particular business.

For further discussion, please turn page.

More Sides To a Complex Problem

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IT IS INTERESTING TO NOTE that when the AEC first announced its program, there were those within the mining industry who yelled, "socialism," "Government monopoly," "Government control," and even outright "dictatorship." Yet the experience of the industry has been that the AEC, more than any other agency of Government, has engaged in fair dealing and its policies and programs have, for the most part, been appproved by the mining industry. The criticism which has been given considerable attention in the press is largely the result of irrational thinking on the part of overenthusiastic individuals. It does not reflect the thinking of the large majority of uranium producers on the Plateau.

The mining industry, generally, is convinced that it should step up production and is not fully advised as to why additional milling facilities are not now being constructed on the Plateau. It is not clear to the mining industry why Congress saw fit to disallow the request of the Commission for additional funds for milling facilities. The assumption is that Congress preferred to see additional mills constructed by private capital. Again, if this is the desire of Congress, it would seem wise for the Commission to adopt a policy which would enable those who plan the construction of mills to make a profit in line with the risks involved, as suggested by Mr. Wilson.

It is the profit motive which entices the miner to engage in the search for uranium. If he is deprived of the profit motive by establishment of a price for uranium concentrates which will not afford him the advantages of the present system, he will react in a vociferous way which may be heard even in political halls.

In the event prices are fixed for concentrates, some of the prevailing practices which exist in the mining industry generally might apply in setting up a pattern for settlements between mill and producer. Through the years miners have consistently criticized buyers of concentrates and ores for their refusal to pay for the metal content of the ore to which the miner feels he is entitled. Perhaps a few illustrations might be given under present procedures where AEC supervision has brought about more equitable settlements. This is not intended as a criticism of present-day smelters or of the officials of buying plants, but rather to offset the argument that because certain procedures exist in the mining industry generally, and have been more or less adopted through the years, that they should be followed by the uranium industry.

In the matter of advisory "commissions," the difficulty experienced by our association in national advisory committees has been the selection of personnel who are willing to forget private connections and problems for the good of the nation. Experience has shown that individuals on loan from various companies, with perhaps the best intentions may be, nevertheless, slightly persuaded in their judgment by former and perhaps future connections. An illustration of this was the Advisory Committee set up by the former Secretary of the Interior. The zinc and lead committees were constantly in an uproar and little if any accomplishment was ever reported. Yet the personnel of these committees was topflight. Certainly, it would not be a part of wisdom to involve the uranium industry of this nation in a similar fog.

The association undoubtedly will join Mr. Wilson in any attempt to bring about improvement whether it be by a carefully selected board of review or panel or by a commission composed of businessmen, lawyers, Government folk and professional people. It is likewise true that most of our members have expressed themselves as favoring general solutions to problems including the milling problem rather than special deductions.

Other questions might be asked. Does the AEC have such a program in mind in delaying its decisions with reference to the larger mills which eventually may be constructed in various centers? Are advances being made in this field which would be of tremendous value to the miners? To use the negative approach, is there any thinking in high circles that a change in policy with reference to the buying of ore and the placing of restrictions on the sale thereof would tend to discourage the small and medium sized operator and force additional consolidations which are taking place even under present conditions?

The trend towards monopoly has been given much publicity in the press. It is to be hoped that while proper encouragement should be given to major producers and major mill operators in the Plateau area, the Government should adopt no policy which would discourage the rank and file miners to search out, find, explore, develop and mine uranium-bearing orebodies on a strictly private enterprise basis.

The uranium business has grown to one of major importance not only to the people in it but also to the economy of the country. Policies which have been tried and proven should, in our judgment, not be sidetracked merely for the purpose of gaining additional milling facilities, as badly as they are needed. Surely, under current procedures and with present personnel, the Commission *is* capable and *can* come up with a solution of the problem of milling expansion. It is hoped that within the immediate future there will be enough elasticity in the program adopted to enable additional milling facilities to be provided without further delay.

Agreement in Fact.... Difference of Opinion

To CLAIM that the foregoing discussion, coupled with last month's remarks by Carroll Wilson, buttons up all the problems of uranium milling policy would be a large overstatement. It does, however, reconcile what appeared to be conflicts in some cases: In other cases it simply sets forth one or more opinions which then provide a sounder basis for judgment. Let's examine a few key points.

Take the fundamental question of whether or not there is a bottleneck in uranium milling. On the basis of the huge stockpiles of ore accumulated on the ground on the Colorado Plateau, and on the basis of remarks made by AEC otherwise concerning producing uranium, Mr. Wilson cannot be faulted for his deduction that there is a bottleneck in the process of getting uranium "into the can."

In the previously-unrevealed picture before us (see chart page 75) one can judge better what is happening. In the past, milling capacity has run behind ore receipts by about one year, the time it takes to establish ore reserves and construct the mill. Despite gains in ore receipts, milling capacity will soon be adequate to handle current production and to start on the backlog. Moreover, in terms of increased mill capacity, ore on top of the ground represents considerably fewer days' supply of feed than it did when the accumulation began.

Nor is this inconsistent with the affirmation by Mr. Johnson and other AEC officials of the continuing demand for uranium. With nine mills operating and two under construction, representing a seven-fold increase in capacity, the point is well underlined. Thus, when the picture is filled out, the Wilson and Johnson views are not necessarily in opposition.

Fixed Concentrate Prices

When it comes to a fixed price for uranium concentrates, however, there are almost as many differences as there are parties concerned. Mr. Wilson suggested that a schedule for purchase of uranium concentrates by AEC be published; that the schedule have built into it the penalty and premium similar to the schedule for ore buying improvement. This arrangement, argues Mr. Wilson, would provide an incentive to the mill man to improve metallurgy and otherwise cut costs to enhance his profit. With strong historical backing, Mr. Wilson points out that this private enterprise system means faster progress in process development.

Mr. Johnson maintains that a fixed price schedule for concentrates is impossible while a fixed schedule for ore prices is in effect. Among other difficulties, mills would avoid taking low-grade ore—which costs them as much per ton to mill as high-grade ore but contains less concentrate on which they would be paid.

Furthermore, Mr. Johnson takes exception to the inference that present metallurgical development under AEC falls short of where it might have been under private enterprise. Unlike the case of ore receipts vs milling capacity, Mr. Johnson, presumably because of security regulations, offers no evidence supporting his view, so this subject must perforce remain a matter of one man's opinion against another's.

Mr. Palmer does not hold with Mr. Wilson's idea that under a schedule of fixed concentrate prices, mills could negotiate with miners along the pattern developed over the years by custom smelters. He feels that long usage doesn't necessarily make the practice satisfactory and that other means of negotiation should be examined.

Mr. Burwell puts his finger on vanadium as the real fly in the ointment of fixed prices. He pins down the economic problem in terms of historical background and actual metallurgical practice. His solution: Vanadium must stand on its own feet. Vanadium's solution: Active market research and development.

Examination by Commission

One solution for the uranium milling problem offered by Mr. Wilson on the basis of its success in other areas was the appointment of a commission to study the whole problem from the points of view of all concerned—miners, millers, AEC and taxpayers. Each of the immediately concerned groups would have representation, but the bulk of the commission would be composed of people from other walks of life—lawyers, business men, Government people, etc. This commission would hear all sides of the case and come up with a recommendation for a course of action which might be simply administrative procedure or might involve enactment of new laws.

Mr. Palmer considers this a sound approach but Mr. Burwell sees little to be gained by such a step. Mr. Johnson points out that the Raw Materials Division of AEC has always had an Advisory Board made up of prominent citizens in the raw materials industry. How near this comes to conforming to Mr. Wilson's concept seems to be a question of definition of terms.

In Conclusion

Never before has the uranium milling situation been brought so sharply into focus as it has been by what you have read on the preceding pages. Carroll Wilson's probing in last month's issue of *E&MJ*, appeared completely justified on the basis on the information, experience and ideas which it has evoked.

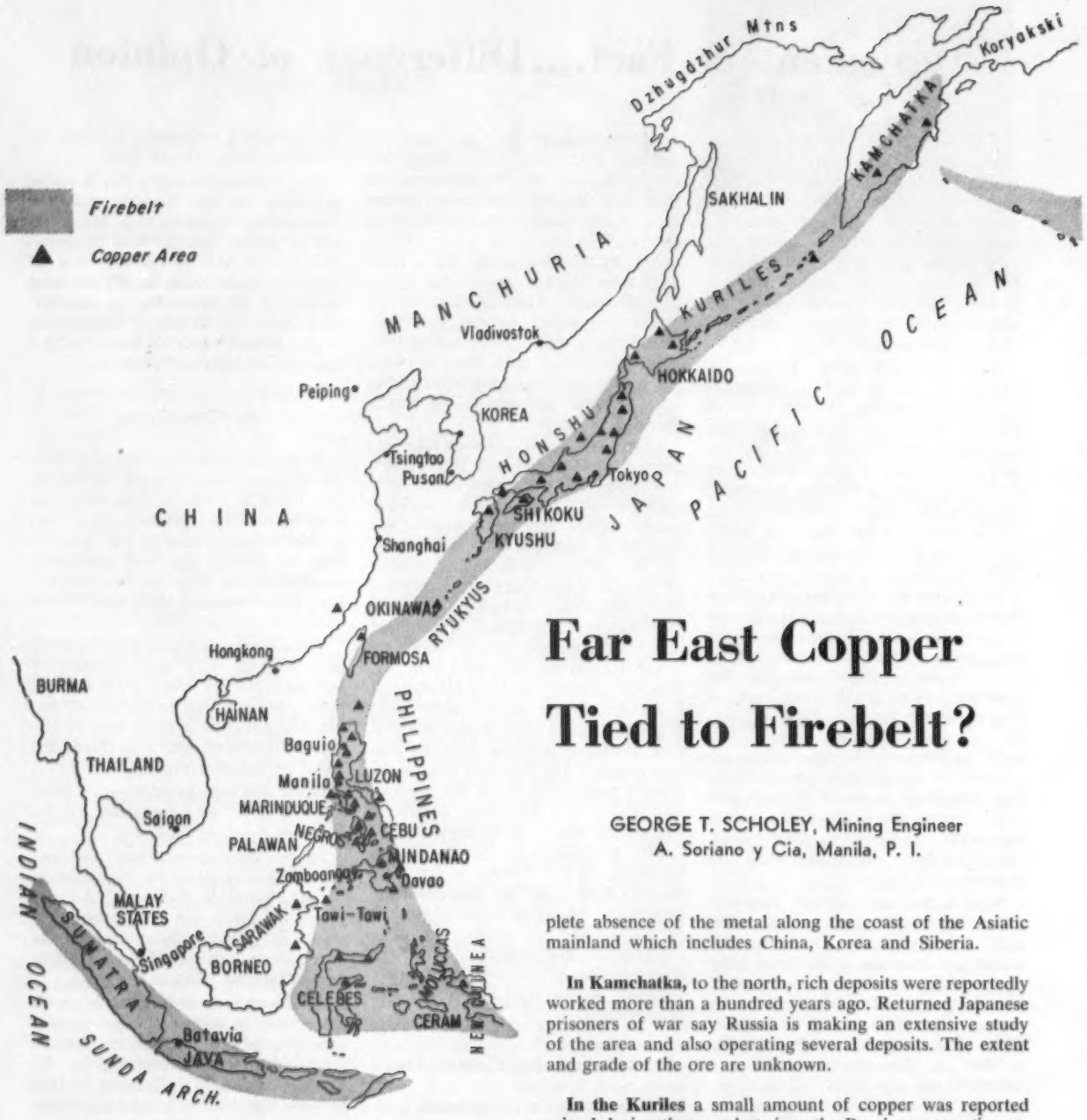
Certain facts in the case could come only from the AEC and regardless of attitude, pro or con toward AEC policy, one must agree that Mr. Johnson has disclosed a great deal of significant information to help clarify the status of uranium milling.

Other quarters, in addition to those recorded here, were contacted and the response deserves reporting.

Several companies already engaged in milling were asked for their opinion of Mr. Wilson's statement. All declined to reply for publication because they were then engaged in negotiations with the AEC, an entirely understandable attitude.

Off-the-record conversations with individuals in some of those companies revealed concern with the vanadium problem so ably discussed by Mr. Burwell (page 78). Opinion is that by and large AEC is doing a creditable job and that "growing pains" of a young industry are the chief source of difficulty. Each party had its personal observations on a particular and usually minor grievance with AEC policy, but these did not effect their over-all opinion.

To run the gamut of approaches to the milling of uranium we also asked for comment on Mr. Wilson's remarks from a few who have been close to vehement in their criticism of AEC policy. To date we have heard nary a word from this group, a circumstance which may or may not be significant.



Far East Copper Tied to Firebelt?

GEORGE T. SCHOLEY, Mining Engineer
A. Soriano y Cia, Manila, P. I.

THE ORIENTAL LEG of the so-called "Pacific Fire Belt" sweeps in several arcs from Cook's Inlet in Alaska to Kamchatka, then south to Formosa, and finally through the Philippines into the Moluccas. Here its linearity is lost by junction with the fire belt curving down from Java. It is characterized by prominent volcanism apparently caused by the tectonic zone it follows. The extreme faulting in the Philippines, Formosa and Japan, and the approximately 40,000-ft chasms east of the Philippines and Japan, show that there has been intense movement.

Copper mineralization seems to have a close relationship to this firebelt as evidenced by the large number of copper mines, shown as triangles on the map, and the almost complete absence of the metal along the coast of the Asiatic mainland which includes China, Korea and Siberia.

In Kamchatka, to the north, rich deposits were reportedly worked more than a hundred years ago. Returned Japanese prisoners of war say Russia is making an extensive study of the area and also operating several deposits. The extent and grade of the ore are unknown.

In the Kuriles a small amount of copper was reported mined during the war, but since the Russian occupation no further information is available. One of the deposits occurred almost on the edge of an active volcano and was therefore of very recent origin.

Japan, up to 1935, was self-sufficient in copper, having a large number of mines throughout the Archipelago and Formosa. The copper appears to show no particular affinity for any type of host rock. It has been found in narrow fissure veins in diorite such as the Nikko mine north of Tokyo; in massive deposits such as those near Hitachi, east of Nikko; in complex ores such as at Ikuno and Akenobe, where it is in a fine grained mix of lead, zinc, tin, gold, silver, tungsten, arsenic and magnetite in host rocks of slate, diorite and diabase; and in relatively simple chalco-

pyrite-pyrite ores in the Shimokawa mine of northern Hokkaido, the Makimine mine in Kyushu and the Sado mine off the west coast of Honshu. At the latter it occurs fairly uniformly through a quartz vein carrying substantial values in gold. Gold is present in most of the Japanese mines, ranging from a small fraction of an ounce up to where it is the predominant metal. At present most of more than 50 producing mines are low grade, having been impoverished during the war. However, recently the Mitsubishi Mining Co. has opened a rich deposit on the island of Hokkaido and Nippon Mining Co. is operating a high grade mine which furnishes part of the ore for the Hitachi smelter.

In the Ryukyus, south of Japan, a small amount of copper was noted on the northern end of Okinawa, and small amounts have been reported on some of the other islands. Copper in Formosa has been mined on a large scale only at the Kinkaseki mine on the northern end. The ore is in steep dipping veins of enargite with gold, silver and some pyrite. This mine also was extensively worked during the war and the best ore gutted out.

Philippine copper ranges from the island of Bataan on the north, between Luzon and Formosa, to Tawi Tawi on the south, just off the coast of Borneo, and from Catanduanes on the east, just off Luzon, to the island of Lubang on the west, southwest of Manila. Here again there is no particular host rock, but the most common occurrence is in diorite and rocks adjoining diorite intrusions. An extensive line of copper mineralization starts on the northwest tip of Luzon and follows down towards Corregidor at the edge of Manila Bay. The occurrences are mostly in serpentine and range from a light stain to pieces of native copper. However, no deposits of commercial size have been found in the serpentines. Lepanto, which lies in the mountains of Northern Luzon, produces heads averaging 4% copper and 0.21 ounces of gold per ton. The country rock is andesite and dacite and the predominant mineral is enargite which occurs in a large silicified zone. The geology and type of mineralization is almost identical to Kinkaseki in Formosa and these are the only two known deposits of this type in the belt.

Another large deposit is about 100 km north of Lepanto in the wilds of Apayao. Host rock is andesite but the predominant mineral is chalcopyrite. During the war the Japanese ran a cross-cut into this deposit and showed an average of 1.34% copper and 0.04 oz gold over a width of 120 m. Nothing has been done with it since, due to the inaccessibility and presence of dissidents. Copper likewise shows up on the south edge of the famous Baguio Gold District, occurring in andesite and carrying, in some places, substantial amounts of gold. But nothing of any size has ever been opened up. Following the belt on south, intense copper mineralization is noted in Batangas with no preferred host rock. It is found in fissure veins in diorite, in fissures in andesite and in recent chalcedonic spring deposits. On Marinduque Island, south of Batangas, are some of the richest copper ores in the Philippines, notable for their high molybdenum content. Southeast of Marinduque, Masbate Island, known for gold mines before the war, has a wide distribution of copper in the basement complex, as well as in diorites, limestones and andesite. But nothing of importance has been opened up due primarily to lack of development work.

On Catanduanes, to the east of Luzon, copper occurs as native copper flakes in a black slaty material which, when hot, will disintegrate in water allowing the copper to be screened out. On the island of Rapu Rapu, which lies about 50 km south of Catanduanes, copper is associated with massive pyrite lenses in schist. Prior to the war the Hixbar mine produced more than 100,000 tons of ore which averaged 10% copper, 40% sulphur, and 0.10 oz gold per ton. Recently a large copper deposit has been developed in the island of Cebu and a 4,000 tpd mill is being erected. The body is 1200 ft long, 700 ft wide and 600 ft deep with the ends and depth still open. Host rock consists of diorite and meta-andesites and the over-all value is 1.15% copper and 0.015 oz gold per ton. A massive deposit in a coarse grained diorite at Sipalay on the west coast of Negros is also being diamond drilled.

Copper is found throughout Mindanao. On the east coast, in the Lanuza area, it is characterized by occurring in massive basalt as oblong pipes, from a few feet up to a hundred or so feet along the sides, which consist of almost massive pyrite with a few per cent of copper and zinc and a small amount of gold. In the Cagayan area on the north coast, copper is along an extensive belt in fissures in andesite which are underlain by diorite. On the islands of Tawi Tawi and Tumbagaan small rich deposits are in serpentine.

In the Celebes, copper is widely dispersed, but nothing of importance has been developed due to adverse conditions for investment and labor. Borneo, like Formosa, lies on the edge of the fire belt and a number of high grade copper deposits are known but again unfavorable conditions have hindered exploitation. Copper has been noted at various places in the Moluccas and Ceram but nothing ever developed. And rich deposits have been reported on the western tip of New Guinea but, like most of the area south of the Philippines, adverse conditions have always hindered opening them.

Korea, in the north, lies just off the edge of the fire belt and is characterized by a predominance of granite forming the mountains and deposits of limestone, sandstone and slates on the lower areas. Although the country contains a tremendous wealth in minerals, especially in gold and tungsten, only a few small copper deposits have been found. Some of these copper deposits have been high grade producers and it is possible, of course, that more will be discovered. A small amount of copper mineralization was noted on the Manchurian border just north of the Yalu River but was too minor for even the Japanese to work during the war when copper was of prime importance.

The China Coast, lying considerably to the west of the fire belt is extremely rich in tin and tungsten with some gold and lead, but is notable for its almost complete absence of copper. Although noted in many places, it has only been recorded in commercial quantities from one small mine near Amoy. Copper occurred at times in small lenses in the lead property of Hong Kong mines but never in commercial quantity. Likewise while there was much lead, tin and tungsten in Hainan, only specimen pieces of copper minerals were noted.

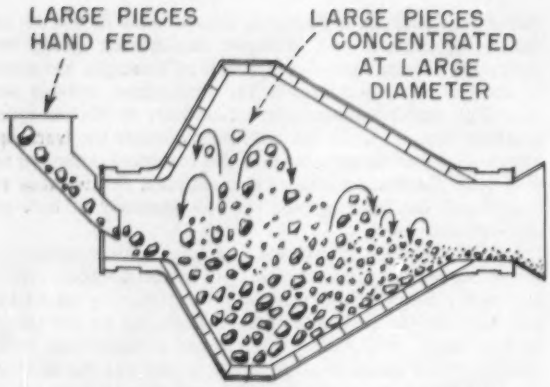


FIG. 1: CONICAL MILL operated in 1908 using 8-in. run-of-mine ore as the grinding media.

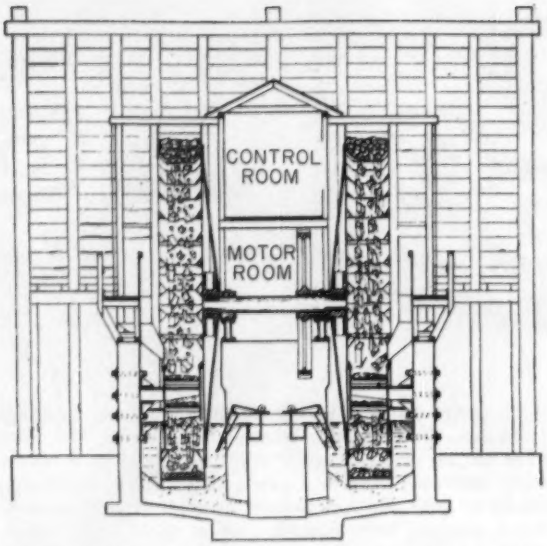


FIG. 2: HADSEL MILL as first developed in 1932, used lifting buckets. Ore was scooped out of classifier tank in which mill

A manufacturer candidly discusses the problem of . . .

Making Rock Grind Itself

HARLOWE HARDINGE
Hardinge Co.
York, Pa.

Editors' Note: Advantages of autogenous grinding are obvious, the disadvantages sometimes obscure and the disappointments of over-eager, under-experienced practitioners have perhaps given AG an undeserved black eye. In frankly relating his experience in developing a mill that will permit rock to grind itself, Mr. Hardinge renders a valuable service, for each arduous step forward sheds light on the pitfalls, defines the limitations or points up the potential of autogenous grinding—a potential that mill men have sought for more than 50 years.

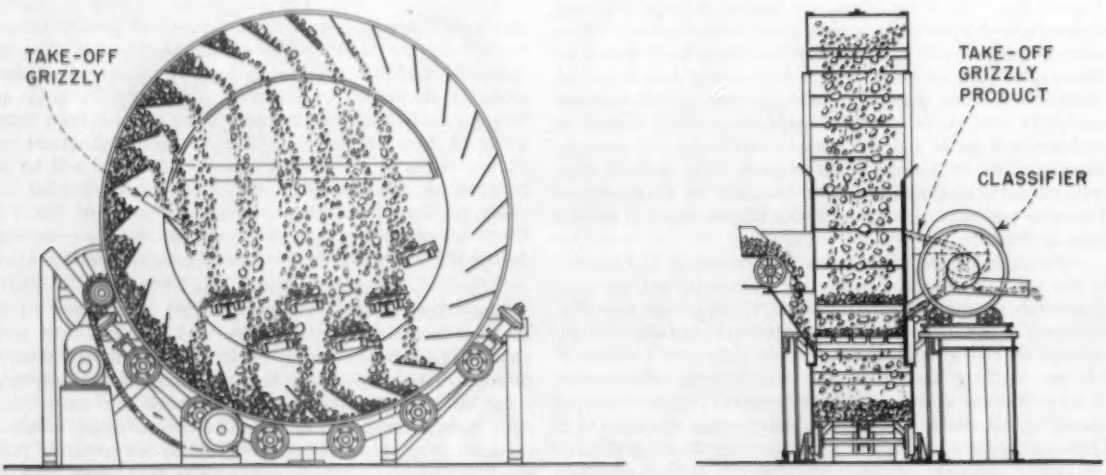
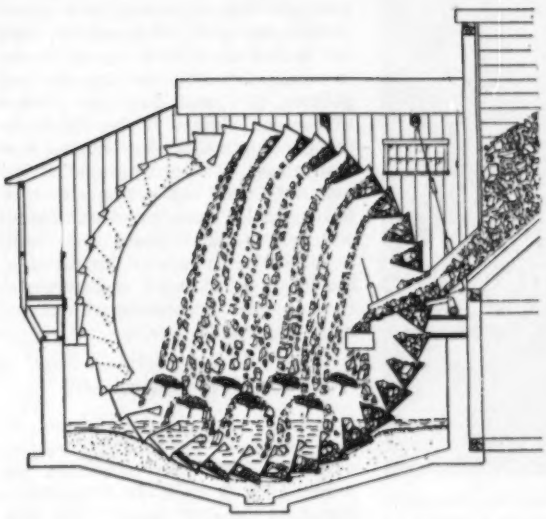


FIG. 4: HARDINGE-HADSEL MILL in 1934 design, was mounted on tires and operated in closed circuit with an independent counter-current classifier. This model operated successfully at a number of gold mines.



was submerged, and dropped on stationary plates cantilevered from wall. Classifier arrangement proved unsatisfactory.

FIG. 3: DUPLEX HADSEL MILL, 24 ft in diameter looked like this in the shop before shipment.

USING LARGE PIECES OF ROCK to crush themselves and grind the little pieces is not new. The basic principle has been applied in one form or another down through the ages, but it has only been in the last 40 years, more or less, that methods have been developed which, where they apply, are competitive with other mechanical means of grinding.

My personal experience and knowledge is limited to conducting this operation in some sort of a tumbling mill, which, up until now, is the one basic method that has proven economical under conditions where autogenous grinding can be applied. The over-all problem is one of mechanical handling of the rock or ore, not only in the device itself, but also its proper preparation prior to entering the grinding, or let us say, self-grinding device.

Early Work

Confining my historical references to the 20th century, there was an interesting connotation in the paper by my father, which was delivered at the Birmingham meeting of the AIME, October 1908, in which the basic principle of the Conical Mill (Fig. 1) was described. It included the following statement:

"The ore fed to the mill was run-of-mine, which was first shoveled by a coke-fork having tines spaced 1 in. apart, the coarse material being rejected, so that the undersize was 1 in. and finer. The mill contained 2,000 lb of 2- and 3-in. pebbles. The ore was crushed to 80-mesh size at the rate of 4 tons per hour at an expenditure of 17 hp. This type of mill appears to be specially adapted to the use of lumps of ore instead of the usual foreign bodies for grinding. In a separate test on Pennsylvania magnetite, pieces as large as 8 in. in diameter were fed to the mill and the charge was ground at the rate of about 2 tons per hour, the product being reduced to a fineness corresponding to the results obtained in the first test on magnetite mentioned above."

Unfortunately we do not know the length of the test referred to, nor whether the operation would have run into the problem of critical size encountered in later work. (Critical size in autogenous grinding is that portion of the feed which is above the desired product size but too small to do any grinding.) The fact remains that in the Conical Mill the large pieces effectively crushed the small pieces under the conditions noted and produced a fine product.

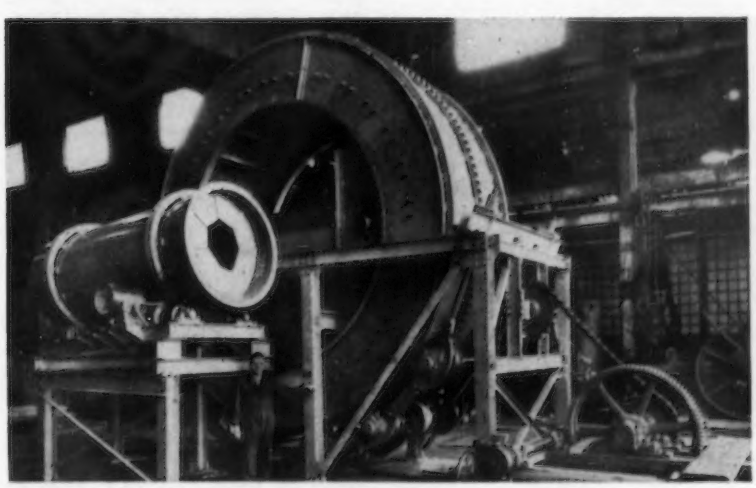


FIG. 5: HARDINGE-HADSEL MILL shown with classifier had a unique drive with the chain contacting only one portion of the rim.

Another Installation

Nulsen Corp. at St. Louis, Mo., about 1916, and for a number of years thereafter, ground barytes with barytes lumps in an 8-ft-diameter conical pebble mill with a 30 in. cylinder. The lumps of barytes ore were fed separately to the mill as grinding

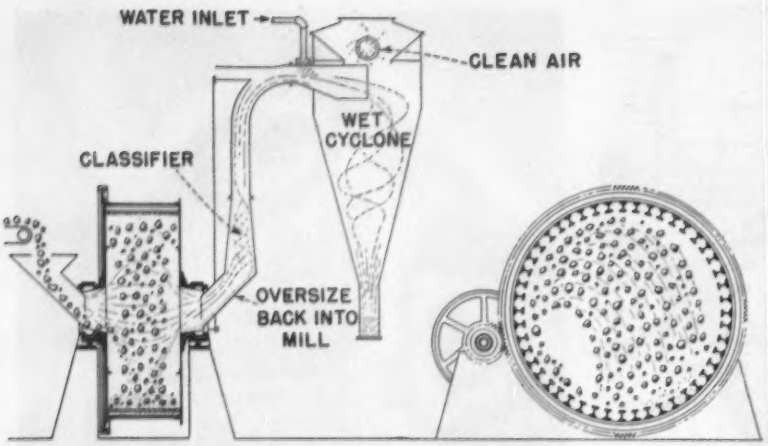


FIG. 6: WESTERN-HADSEL HIGH SPEED MILL was designed in 1936 for dry grinding with product removed by air sweeping. Note angle deflectors on walls.

FIG. 7: SEGREGATION OF CHARGE as shown inside mill at Harqua Hala Mines, Salome, Ariz., plagued the Western-Hadsel mill as it did the earlier models.

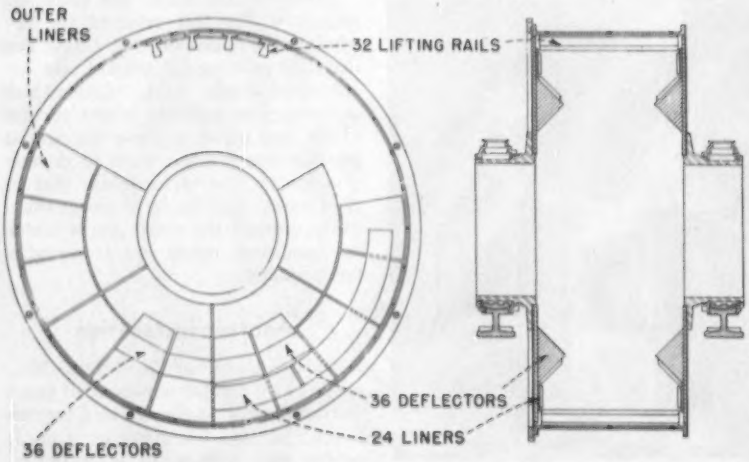


FIG. 8: REVISED DRY-GRINDING HADSEL MILL for installation at Trail in 1939, used large deflectors, short cylinder to prevent lateral segregation.

media, while the balance of the feed was pre-crushed to 1-in. size before entering the mill. Flint pebbles were not used because with the difference in specific gravity of barytes and pebbles (4.6 and 2.6) the pebbles would tend to float. Using barytes as the grinding media also reduced contamination. The mill ground at the rate of 1½ to 2 tons per hour to 95% through 325 mesh in closed circuit with a classifier. These early mills were of large diameter compared to the length of cylinder and were run close to the theoretical centrifugal speed, usually 85 to 90%.

Original Hadsel Mill

Now we come to the invention of A. D. Hadsel. His first mill was installed in 1932 and it utilized the principle of a high drop against a stationary breaker plate. The first description of this device was printed in *Engineering and Mining Journal* in April 1932. Fig. 2 and Fig. 3 show an arrangement of the mill which, in its first concept was 24 ft in diameter, took run-of-mine ore in sizes up to 12 in. successfully, and produced a product of approximately 60 mesh, suitable for flotation. The width of the mill was 3 ft.

Elevating buckets were formed of steel plates, extending inwardly from the periphery, inclined to a tangent of 25 deg. One side of the wheel towards the carrying or cantilevered shaft was closed; the other was open except for the rim plate, enclosing the ends of the buckets and extending inward about 5 ft on the radius. These elevating buckets lifted the rock and dropped it from a height upon stationary metal breaker plates, or a series of plates near the rim at the bottom. There were seven breaker plates in number with the lowest plates just above the water level. The mill was operated at 2.66 rpm. As will be seen from the illustration, the lower part of the wheel dipped into a stationary tank or classifier with an adjustable side weir for varying the depth and degree of classification.

The first mill was a duplex arrangement with two wheels supported in a cantilever arrangement from a central shaft and operated by a 100-hp motor. At the time this first installation was made it was assumed that the ore was relatively hard, but later it was discovered that the ore had been taken from a weathered area and broke more readily than unweathered material and without formation of much critical size. Capacity ranged from 275 to 300 tons per day grinding to minus 48 mesh with 60% to 65% through 200 mesh.

Initial results were very impressive

and gave rise to the belief that here was a revolutionary method of grinding. Difficulties soon became evident, however, and as the ore changed, the capacity decreased, mechanical weaknesses developed, and the tank in which the wheel operated proved to be a poor classifier. An outside classifier arrangement had to be devised. Sulphides released from the ore settled to the bottom of the tank, and finally built up to a point where the friction load on the machine became great enough to stall the mill and to wear the scoop tips badly.

Self Contained Hardinge Hadsel Mill

To overcome the basic weaknesses, the machine was completely redesigned, and while the wheel elevator principle was retained, the new mill was a self-contained unit mounted on rollers running under steel rails encircling the rim. This eliminated the central shaft and the bottom scoops entirely.

A unique drive was used with a chain contacting only one portion of the rim. This method worked satisfactorily after several modifications.

Ground and semi-ground pulp, which first spilled off the edge of the buckets, was removed by a takeoff grizzly as can be seen in Fig. 4 and 5. An independent classifier then made the proper separation, returning oversize to the mill. A description of this operation and the development of this mill was covered by R. G. Hall, AIME Transactions, Vol. 112, 1934.

A number of installations were quite satisfactory. Unfortunately, in most cases, the mines were not of sufficient worth, and World War II restrictions shut them down.

In other cases, we were plagued with a buildup of so-called critical size. This size ranged from about ½ in. to 1 in. and the rounded pieces building up in the mill reduced the capacity to a marked degree. In several cases it was necessary to remove this critical size material and grind it in a separate ball mill. The operation then became economic except for the surges in over-all capacity that took place when ore from the mine did not come in fairly uniform size ratios.

Had we known and developed the segregated feed system later to be described, the whole picture of this original type of wet grinding mill might be quite different. It still offers intriguing possibilities, where conditions permit. The mill design, as indicated, now is much simpler than was developed at that time and resembles more the very short-cylinder large-diameter original Conical Mill.

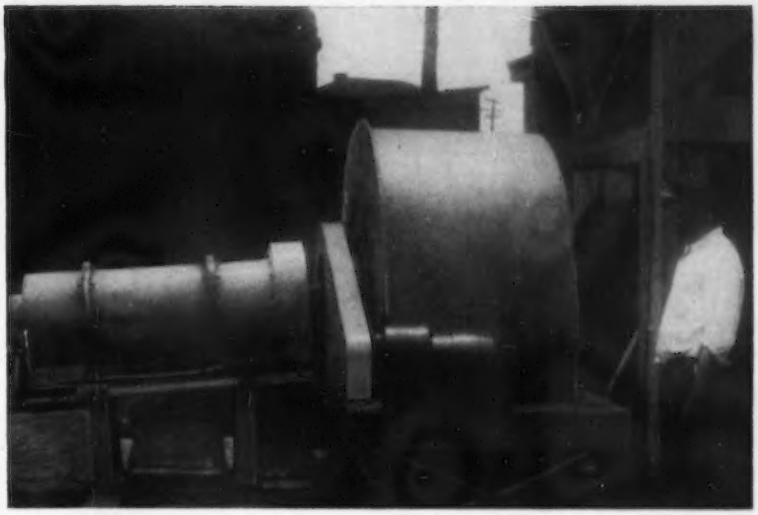


FIG. 9: CASCADE MILL, 1936 design, operated at test plant in closed circuit with counter-current classifier which returned oversize to discharge end of mill.

One interesting operation, interrupted by World War II, was described in AIME Transactions, Vol. 134, page 236, by George A. Bell. It covers milling operations at Demonstration Gold Mines, Philippine Islands, where the Hardinge Hadsel Mill was used as a scrubber and preliminary grinding mill, taking a very wet, sticky ore and preparing it for final grinding in the ball mill. Feed size was 12 in., the product size approximately 1 in. The 1937 costs for this washing and crushing operation were given as $0.1240 per ton at a capacity of about 200 tons per 24 hours.

Dry Hadsel Mill

While we were having our troubles with the wet grinding mill, Hadsel developed the Western Hadsel High Speed Mill. The principle was very similar to standard air sweeping, but again the large-diameter short-cylinder mill was employed. Fig. 6 is taken directly from an early drawing, dated Jan. 8, 1936. Angle deflectors are shown on the sides of the mill to keep the ore from wearing the sides as it drops from the rail type lifter bars on the periphery.

Another serious defect, however, developed in this mill. Lateral segregation took place as the air passed through the mill and caused the large pieces to grind upon themselves. The fines blown toward the discharge end had practically no large pieces mixed therein to do any grinding in this zone. The oversize removed was again returned to the discharge end by an expanded pipe type classifier, further hampering efficient grinding action. The inside of the mill installed at the Harqua Hala Mines, Salome, Ariz. (Fig. 7) shows that much larger deflector castings were installed in this mill in an attempt to avoid the lateral segregation, but segregation still persisted. Corrective measures with this shaped mill were to install either large deflectors or a larger diameter, narrower shell, or both.

A short time later, Consolidated Mining and Smelting Co., British Columbia, became interested in this type of mill, particularly for operations in districts where the supply of grinding media was difficult to transport to the mill site. The internal appearance of this later design of mill is shown in Fig. 8. The classifying arrangement generally was the same, although modifications were made to the method of wet collection which had caused some trouble in earlier installations.

Here again they were plagued with the variation in tonnage resulting from changes in the ratio of coarse to fine ore in the feed. Operations would proceed satisfactorily for awhile and then critical size would build up in the mill, reducing capacity.

Feed Control

While these mills were built at Consolidated under their own direction, we made several suggestions as to improvement of their operation. One suggestion was the use of the "Electric Ear" which materially assisted them in obtaining a steadier operation. The sound of the mill controlled the feed rate and thus eliminated, to some degree, the buildup of critical size

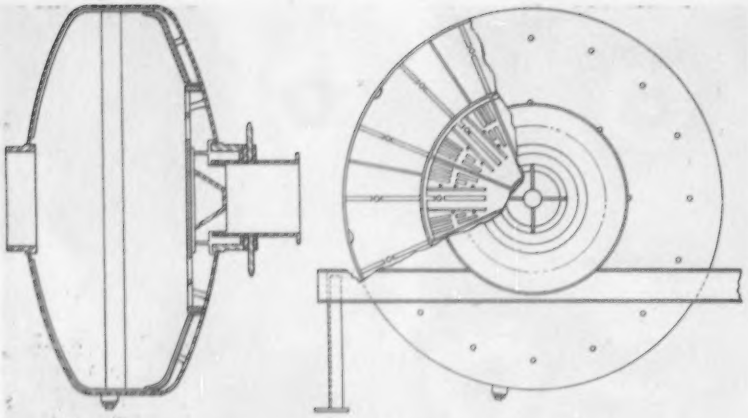


FIG. 10: CASCADE MILL with convex head was equipped with discharge grate for wet grinding. This unit is 6 ft in diameter.

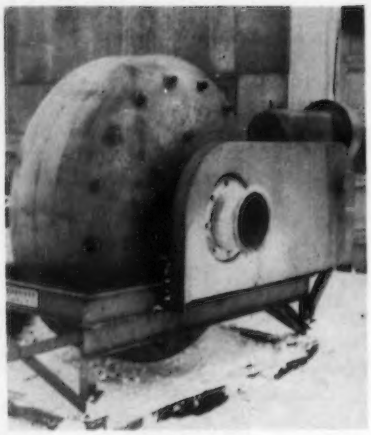


FIG. 11: SAME MILL is being tested extensively for wet and dry grinding.

that otherwise might have occurred. Attempts had previously been made at feed control based on variation in power consumption of the mill. This type of control did not prove reliable, as it did not indicate the true conditions within the mill—at least not as accurately as change in sound apparently does.

In earlier developments of this mill, Hadsel worked on an arrangement of registering the degree of weight change in the mill itself to regulate the feeder, but this never proved practical. The idea is intriguing however, but in all probability the same results obtained with power variation would occur in this case too.

Wet and Dry Cascade Mill Tests

Having encountered one difficulty after another, and not knowing whether wet or dry grinding was the answer to this problem, we made a number of semi-plant size tests. One interesting wet grinding arrangement treated run-of-mine feed. Fig. 9 shows the outside of a 6-ft-diameter wet Cascade Mill with lifters discharging directly to a counter-current classifier at an elevation which permitted classifier oversize to be returned directly to the mill. Tests were successful but the development was never carried to conclusion. Returning oversize to the discharge end of the mill is a condition which normally would be frowned upon. But when we bear in mind that a very short cylinder mill is used, and the distribution of this oversize throughout the mill would take place almost instantaneously in the case of a wet pulp as opposed to a more sluggish dry load, the loss in efficiency in not returning the oversize back to the feed-end is probably nominal.

Another type of 6-ft-diameter Cascade Mill with convex heads (Fig. 10 and Fig. 11), was and is extensively being tested for both wet and dry grinding of run-of-mine and other size ranges of feed. Wet and dry classifiers as well as screens of various meshes have been incorporated in the circuits employed, and capacities range from 100 lb per hour to well over a ton per hour depending on conditions. This is one of the basic design forms that has proven quite practical.

When we first made these tests, we ran up against the problem of some critical size just as we had in the field with the wet grinding Hardinge Hadsel Mill. To overcome the difficulty when it occurred we added a few balls to the load, which remained in the mill, and effectively broke down this critical

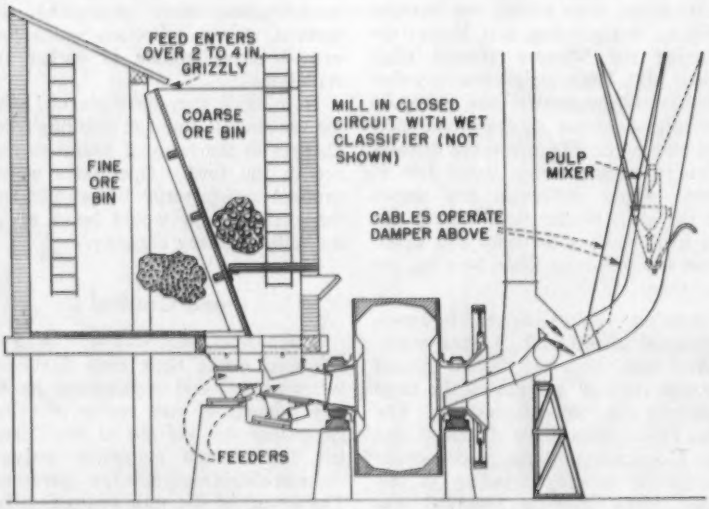

FEED ENTERS OVER 2 TO 4 IN. GRIZZLY
COARSE ORE BIN
FINE ORE BIN
MILL IN CLOSED CIRCUIT WITH WET CLASSIFIER (NOT SHOWN)
PULP MIXER
CABLES OPERATE DAMPER ABOVE
FEEDERS

FIG. 12: PORTABLE CASCADE MILL for wet or dry grinding, features large diameter, short width trunnions for easy coarse feeding. This is 1945 design.

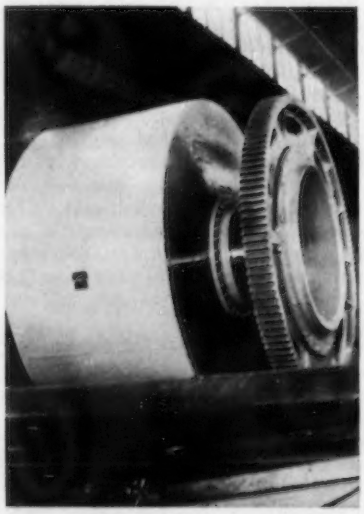
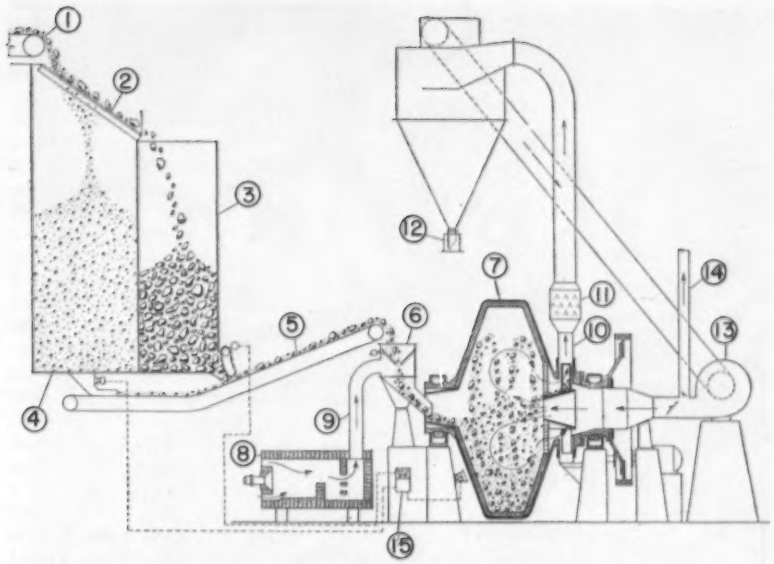


FIG. 13: SAME MILL ready for shipment to Century Mining Corp.



LEGEND

1. Run-of-mine feed or coarse crusher product.
2. Adjustable bar grizzly.
3. Bin for coarse portion of feed.
4. Fine bin feed.
5. Feed conveyor for recombined and proportioned sizes.
6. Feed hopper for feed and hot air.
7. Hardinge Cascade Mill.
8. Air heater used when feed exceeds 2 to 4% moisture.
9. Hot air to mill, dries material while mill grinds.
10. Moist air plus semi-ground product drawn out of mill.
11. Air classifier rejects and cleans oversize.
12. Finished product separated from air in collector and discharged to bin or conveyor at any convenient height.
13. Air from system drawn into fan and blown back into mill.
14. Moist air vented to atmosphere or other collector system.
15. "Electric Ear" sound control keeps mill at constant grinding efficiency by automatically proportioning coarse to fine feed sizes for best operating condition.

FIG. 14: HOT AIR is used in this model to dry the feed. Principle of segregating coarse and fine feed has done much to eliminate critical size. Control of feed ratio of coarse to fine is handled here by an "electric ear."

size. The ball load probably ranged between 1% and 10% of a normal ball mill load, but it was sufficient to eliminate this difficulty and without any appreciable increase in over-all power consumption.

Divided Bin and Size Control Development

At this time, we began a series of tests in which we took run-of-mine ore and separated it into two sizes. We then fed these two sizes roughly in proportion to the amount of each so that we would wind up with nothing left over of either size, or at least maintain the amounts of the segregated sizes in the bins relatively constant. Our first opportunity to prove this in practice was at Century Mining Corp., Ltd., Heming Lake, Manitoba, not far from Flin Flon. Here a 10x5-ft dry grinding Hardinge Cascade Mill was installed (Fig. 12 and Fig. 13), incorporating the many features we knew that were required to make a mill function properly on run-of-mine ore to produce economically, an acceptably steady rate of product.

Here run-of-mine ore was run over a grizzly. Fines or approximately minus 2-in. material went into one bin and the coarse into another. Two sets of feeders were employed. The "Electric Ear" was arranged to operate either feeder, but in this case the best results were obtained by controlling the fine feed which was greater in quantity. The coarse feeder was adjusted to feed at a definite rate so that over a period of time neither bin would become overloaded. Only when there was a tendency for an overload of one of the bins was manual readjustment of feed rates necessary.

Any tendency toward segregation was eliminated not only by using the Conical Mill principle to force coarse ore to the center, but also by an air classifying method that caused the oversize to be returned by the reverse current principle. Oversize was thrown clear across the mill, and thus not allowed to remain at the discharge end only. Inasmuch as the ore contained from 3% to 5% moisture, hot air was used to dry the feed as it was being ground. The product was conveyed by air to a dry collector, with the vent going to a wet collector. The dry collector product was pulped and then delivered to the cyanide circuit at the dilutions desired.

The Obstacles

This installation was made in 1941 and was just being tuned up properly when material restrictions were placed upon all gold mines. The operation was closed down, and was never started up after the war. Experience and results obtained proved a system of this kind is practical where such an operation is warranted; but there has been a great deal of resistance on the part of mill men to embark on such a radical change in mill operations as, admittedly, many innovations have to be made to insure its successful operation. One improvement we made which greatly assisted the mill on occasion was to bleed off intermediate sizes of particles that were too large to be elevated by air economically and return them to the feed end separately.

We had figured that a mill of vertical sides with deflectors would produce the desired results, but we found later that we still had to put the conical deflector baffles in the bottom to obtain best operating conditions. Final result was that the best mill was the first basic mill type, as tested in 1908; that is, using tapered or conical ends. Hence, whether we operate these mills either wet or dry, we are confronted with the problem of lateral segregation unless we control that condition inside and outside of the mill.

Wet or Dry Grinding

Where hot air can be obtained cheaply or is available without cost, the dry grinding principle, taking run-of-mine damp feed and delivering the finished product, is a practical method of operation. Even though power consumption may be greater, maintenance and linear wear is less. Also, the character of product for some operations lends itself to better control of subsequent treatment than when grinding wet. The basic principle, however, of a large-diameter short-cylinder-length mill applies in either case.

Fig. 14 illustrates a unit where hot air is to be used, which automatically takes care of the coarse-to-fine ratio of feed by the use of separate bins and automatic control on the feeders and by using a reverse current principle of air classification whereby the air is balanced within the mill, as large volumes of hot air must be used where

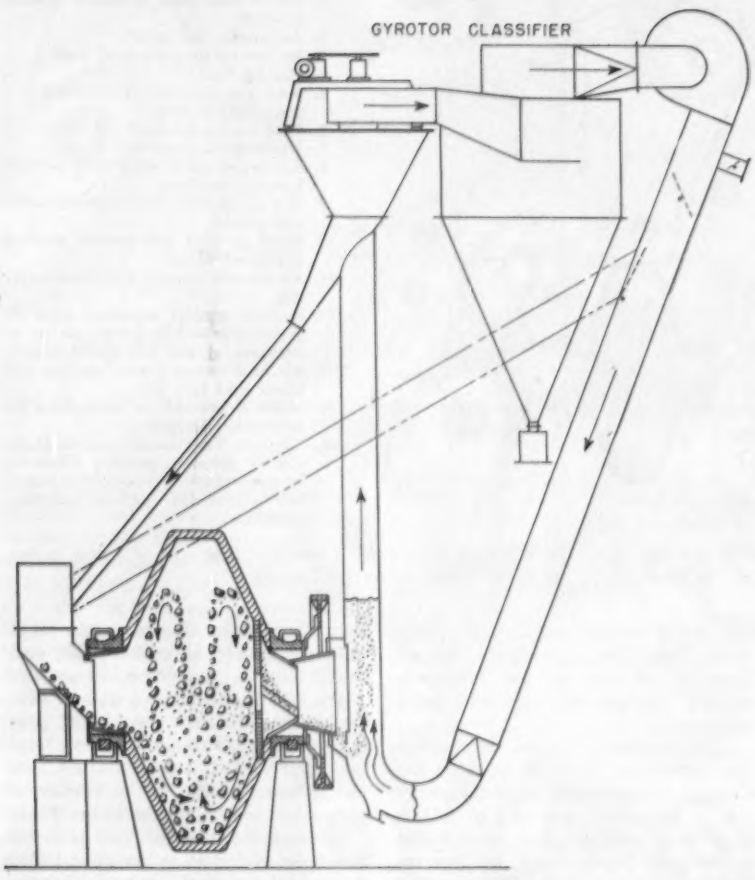


FIG. 15: DRY MATERIAL in this model is discharged mainly by gravity into air stream which reduces the large volume of air needed for air sweeping.

a damp material is to be fed to the grinding unit.

Air Sweeping or Gravity Discharge?

Where the material is relatively dry, the system shown in Fig. 15, with a gravity discharge through a grate into the air column, affords in many cases better control of the action within the mill as the air is passed directly from feed to discharge end, but in small volumes. The main discharge in this case is by gravity and not by virtue of the high volume of air required in the other system.

Arrangement in the unit shown in Fig. 14 permits a coarser more uniform product, if desired. The unit in Fig. 15 also applies for the making of a coarse differential separation and elimination of low grade sizes when the bottom dropout duct is used as has been successfully employed in the asbestos industry. Several of the various arrangements are described in a paper by B. W. Robinson and published in the *Canadian Mining and Metallurgical Bulletin*, December 1954.

Screened and Pre-Sizing Feed as Media

There is a big difference in mill operation if all feed is ground as it comes into the plant or if a portion of the coarse to be used as grinding media is segregated and then the balance crushed to a specified size for feed into a mill along with these coarse pieces. On the Rand in South Africa in a number of cyanide mills and at Lake Shore in Canada (B. S. Crocker, AIME Transactions, Vol. 193, 1952) this pre-selection and intermediate treatment process is preferred feed. On the Rand for instance, there are operations where large pieces, 8 in. and 10 in. in diameter, are selected and put in long tube mills as the grinding media, and sometimes a few balls are added at the same time to reduce the critical size that otherwise tends to build up. The balance of the ore is pre-crushed down to tube mill feed size then fed to the mill.

In 1938, American Nepheline Co. operated a dry grinding 8-ft x 36-in. Hardinge Conical pebble mill in a somewhat similar manner to that described by Crocker, wherein they screened out 3-in. pieces of syenite ore in the intermediate crushing process and fed it to the mill together with the balance of the syenite that had been crushed in a separate operation to approximately 3 mesh. A large grate discharge was used to facilitate high circulating loads. The mill was operated in closed circuit with a vibrating screen. From 40 to 45 hp was required to reduce the 3-mesh feed at the rate of 4½ tons per hour to a final product 3% plus 20 mesh and 14% minus 200 mesh, the syenite pebbles were consumed at a rate of 25 lb per ton, which would ordinarily be classed as unusually high for a pebble mill, but in this case, as the syenite was its own pebble, the high consumption made no difference and, being of the same material, no contamination resulted.

What is the Future of Autogenous Grinding?

From the outline of experience cited here, one might readily ask—What is basically wrong with the principle of making material grind itself and why hasn't this system been more generally employed? The answer is that experience has to be gained and trial and error methods have to be applied before economical methods can be worked out.

Circumstances occasionally have interfered, such as the shutdown of the Century Mine during the war, and progress was delayed.

The basic principle is sound but one must qualify this statement immediately by adding that there are many pitfalls which must be avoided. Our experience has shown some of these pitfalls. It remains for the courageous operator to proceed along the lines experience has indicated to avoid a repetition of the errors made in the past.

We have been asked so many times with revival of interest in this principle now coming to the fore, that I have taken this occasion to review the whole history of this method of grinding, as we, at least, have experienced it. Our experience has now spanned a period of nearly one-half a century and has been very costly to us to date to say the least.

ELECTROLYTIC ANTIMONY is extracted in this 96-cell section containing 8 banks of 12 cells each. Diaphragms are installed in the cells to permit current flow but at the same time maintain separate anolyte and catholyte electrolytic solutions.

Sunshine's Tetrahedrite Ores Yield Electrolytic Antimony

WAYNE D. GOULD, Mill Supt.
Sunshine Mining Co.
Big Creek, Idaho

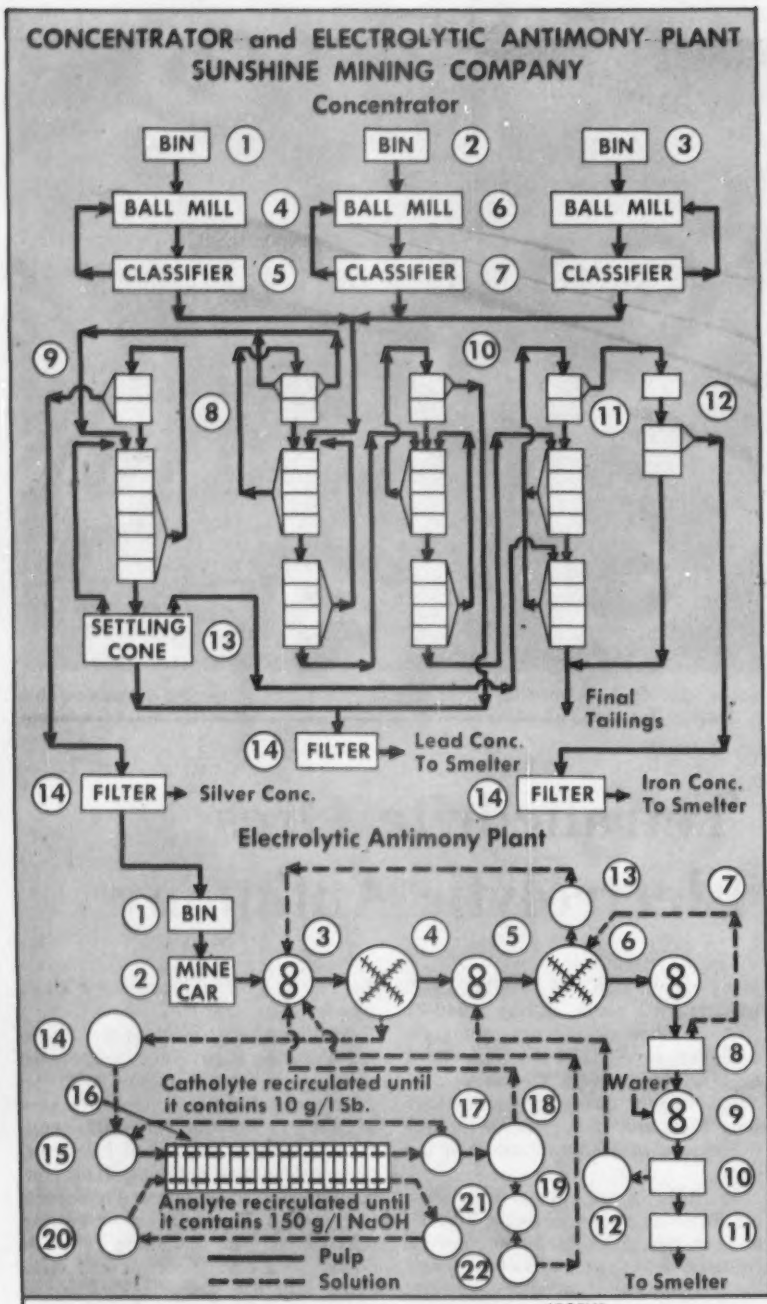
ALTHOUGH THE SUNSHINE PROPERTY at Big Creek, northern Idaho, is generally classed as a large silver mine, it is also a producer of considerable quantities of copper, lead and antimony. Sunshine Mining Co. mines not only its own ore, but also that from adjacent areas in which other companies have participating interests. Current annual ore production amounts to some 250,000 tons with an average per-ton metal content of 34 oz silver and 1.2% lead.

The idea of recovering antimony by electrolysis from concentrates produced in the 1200-ton concentrator matured shortly after discovery of new silver-lead orebodies in the mine. First test work to develop a workable process was initiated in the spring of 1939. Construction and operation of a 1200-lb per day pilot plant followed. After completion of pilot plant tests, a commercial plant was built and actual production of electrolytic antimony commenced early in May 1942. Experimental work during 1940-41 and operation of the new plant are described by W. Church Holmes in *E&MJ*, March 1944. Operating conditions have changed considerably since then, chiefly because of the different type of ore encountered in the mine.

In 1941, the ore came entirely from the Sunshine vein containing little or no lead. Ore mined today, in contrast, contains varying amounts of lead, and the economics of smelter contracts makes it desirable to produce a silver-copper concentrate, a lead concentrate, and a low-silver pyrite concentrate. Argentiferous tetrahedrite is still the chief economic mineral. Mined in different properties its composition varies considerably, even when the ore lies along the same vein structure. Tetrahedrite occurs both as a massive sulphide and as very fine inclusions in the pyrite. Galena is present in varying amounts, as are pyrite, arsenopyrite, and other sulphides. Grinding to 60% minus 200 mesh frees most of the sulphides from the gangue, though it leaves a large amount of middling grain pyrite which must be floated to give a satisfactory silver recovery.

Mill metallurgy involves the following operating stages. First, single-stage grinding in closed circuit with an Akins-type classifier, followed by production of a flotation concentrate containing a major portion of the silver, copper, lead, and antimony. This concentrate, in turn, is retreated to depress galena and float the silver-bearing tetrahedrite. The remaining galena is floated in a second circuit and combined with the retreatment tailing to form the final lead concentrate. In the third circuit the pyrite is floated to produce a silver-pyrite concentrate assaying 50 oz or more silver per ton.

Study of the mill flowsheet will disclose that pulp overflowing the three classifiers serving the ball mills goes to four 56-in. Fagergren rougher cells, followed by four scavenger cells. Concentrate produced by the scavenger cells is returned to the head of the rougher circuit, while the rougher concentrate is cleaned in two 56-in. Fagergren cells with concentrates pulled from one cell only. Some cleaning is being accomplished by countercurrenting the concentrate across the



CONCENTRATOR

1. 250-ton bin
2. 100-ton bin
3. 125-ton bin
4. 9x8-ft Williamson ball mill
5. 48-in. Akins-type duplex spiral classifier
6. Two 8-ft x 48-in. Hardinge ball mills
7. Two 36-in. duplex spiral classifiers
8. No. 1 flotation circuit. Ten 56-in. Fagergren cells
9. Silver retreatment circuit. Eight Agitair 24-in. cells
10. No. 2 flotation circuit. Ten 56-in. Fagergren cells
11. No. 3 flotation circuit. Ten 56-in. Fagergren cells

LEGEND

12. Iron retreatment circuit. Two Agitair 24-in. cells and conditioner cell
13. 10x10-ft cone settling tank
14. Three 6-ft, 4-disk American-type filters

ELECTROLYTIC ANTIMONY PLANT

1. 50-ton bin
2. Mine car
3. Four 10½x10-ft leaching tanks
4. 16x8-ft thickener
5. 7x6-ft agitator
6. 20x8-ft thickener
7. Two 7x6-ft agitators
8. 6-ft, 4-disk American-type filter
9. Two 7x6-ft repulp tanks
10. 8x8-ft drum filter
11. Ag-Cu residue storage bin
12. No. 2 wash storage tank
13. No. 1 wash storage tank
14. 16x10-ft pregnant solution storage tank
15. Two 10x8-ft catholyte head circulation tanks
16. Eight banks of 12 electrolytic cells each, arranged in cascades of 6 cells
17. Two 10x8-ft catholyte tail circulation tanks
18. 16x10-ft barren catholyte storage tank
19. 10½x10-ft anolyte makeup tank
20. Two 10x8-ft anolyte head circulating tanks
21. Two 10x8-ft anolyte tail circulating tanks
22. 10½x10-ft NaOH storage tank

two cells. Tailing from the cleaners is returned to the head of the rougher cells. Reagents used in this circuit, known as No. 1, include Aerofloat 31, which is added to the ball mills at 0.01 lb per ton; reagent 610, also added to the ball mills to depress pyrite; and alcohol, fed to the pump handling the classifier overflow. Final concentrate produced in the circuit and containing the major part of the silver, copper, lead and antimony is sent to the retreatment circuit for removal of lead.

Concentrates Run 1500 Oz

The copper-lead retreatment circuit consists of eight No. 36 Agitair flotation machines arranged as six roughers and two cleaners. Two rougher cells serve as conditioners. Zinc sulphate and sodium sulphite are added in equal amounts to the concentrate received from No. 1 circuit. A total of about 8 lb per ton of concentrate is added, with ⅔ of the amount to the roughers and the remainder to the cleaners. Flotation time in the rougher and cleaner circuits is about 12 and 6 minutes respectively. Galena is depressed and leaves the roughers as tailing to be combined with the concentrate from No. 2 circuit to form the final lead concentrate. The finished concentrate from the two cleaners containing about 1500 oz silver, 20% antimony, 24% copper, 10% lead is the feed for the electrolytic antimony plant.

Improved Froth

Before the tailing from circuit No. 1 enters circuit No. 2 Aerofloat 226 is added to float the remaining lead. This reagent is used because it gives better froth condition. Circuit No. 2 in layout is a duplicate of No. 1 circuit. Equipment consists of 4 roughers, 4 scavengers, and 2 cleaners. A lead concentrate is pulled from only one side of one cell of the 2-cell cleaner unit. As in circuit No. 1 and in circuit

No. 3 following, improved cleaning is effected by counter-currenting the concentrate across the two cells. Finished lead concentrate and the lead tailing from the copper-lead retreatment circuit are filtered in one of the 6-ft, 4-disk American filters available for filtering the diverse concentrates produced before shipment to the smelter.

The mineral remaining in the tailing from circuit No. 2 is pyrite carrying silver in the form of small inclusions of tetrahedrite. Copper sulphate and Z-11 are used to float the pyrite. Equipment contained in circuit No. 3 includes eight 56-in. Fagergren roughers and two cleaners with two No. 36 Agitair recleaners. Tailing from the cleaners is returned to the roughers, while concentrate is directed to a conditioner receiving lime and cyanide to depress the more barren pyrite ahead of the recleaners. Retention time in the conditioner is about 15 minutes. Concentrate grade is held above 50 oz of silver.

Following is an average assay of the three concentrates produced during 1954:

	Silver Concentrate	Lead Concentrate	Iron Concentrate
Ag	1481.8 oz	175.9 oz	79.8 oz
Pb	9.9%	33.8%	5.0%
Cu	24.6%	2.6%	1.3%
Sb	20.1%	2.3%	1.1%

The Electrolytic Plant

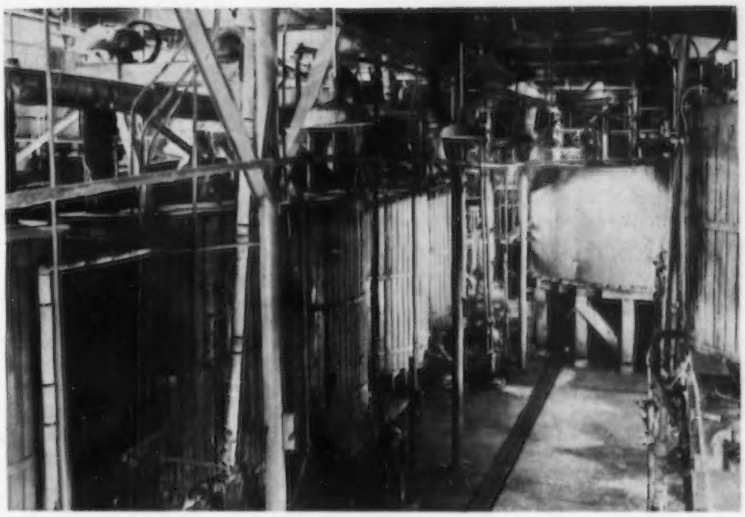
It has long been known that hot sodium sulphide will decompose argentiferous tetrahedrite, forming water soluble sodium thioantimonate or sodium thioantimonite and leaving silver, copper, lead and iron as insoluble residues. The difficulty in its use as an electrolyte has been the deposition of sulphur on the anode and a low current efficiency. However, with a concentrate to market that contains silver, copper, lead, antimony, arsenic and bismuth it can become economical to use a process that would otherwise be impractical. The procedure employed today in the electrolytic antimony plant is explained in the accompanying flowsheet. Briefly, operation is as follows:

1. The tetrahedrite concentrate is leached in hot concentrated sodium sulphide solution to dissolve the antimony.

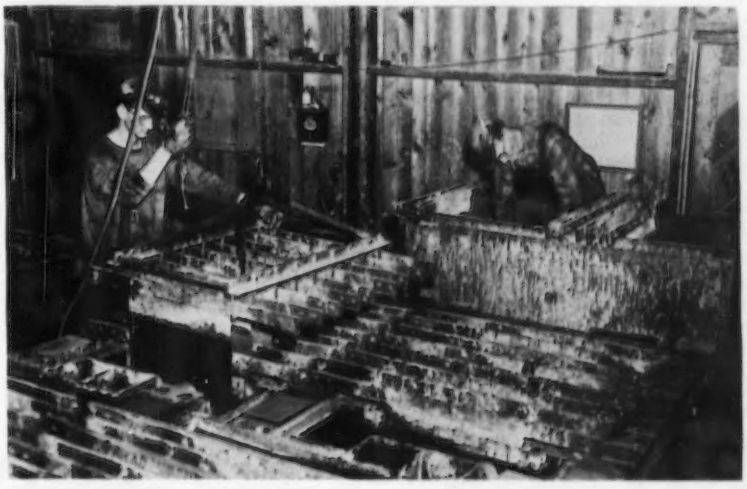
2. Clear solution from leaching is electrolyzed to produce electrolytic antimony.

3. Spent anolyte is discarded to the extent necessary to control impurities in the circuit.

Both leaching and electrolysis are batch operations. Caustic is delivered



ANTIMONY IS LEACHED in mild steel tanks heated with steam coils and equipped with agitators. Sodium sulphide, at a concentration of 300 g/l, is the leaching agent.



TOM POTTHURST, left, and W. T. Sanders remove antimony-laden cell plates and employ chipping hammer to dislodge deposit of metallic antimony.

PLANT PERSONNEL includes Lyle Cornell (left), mill and mechanical foreman, Harold Palmer, antimony plant foreman and Wayne Gould, author of article.

to the plant in 10-ton loads at 50% caustic strength.

Hot Leach Is Required

Leaching is carried out in mild-steel tanks heated with steam coils and equipped with agitators. About 10,000 lb of sodium sulphide at a concentration of 280 to 300 grams per liter, are introduced into a leach tank and heated to above 95 deg C, followed by addition of 5 tons of filtered concentrate. Leaching is carried on at 95 to 100 deg C. At the end of 8, 10 and 12 hr, solution samples are taken and run for antimony and sodium sulphide content. If the antimony extraction is satisfactory at the end of 12 hr the leach is diluted with No. 1 wash solution to 200 g/l of sodium sulphide and pumped to No. 1 thickener. Some loss of solution occurs during filtering. It is made up by addition of sodium hydroxide plus sulphur to form the equivalent of sodium sulphide. A side reaction takes place with the formation of $Na_2S_2O_3$, causing the loss of sulphur and sodium.

Nevertheless, the present method is still cheaper than the use of commercial sodium sulphide. Tetrahedrite will not decompose with sodium hydroxide alone. A close check is maintained on the solutions for both alkalinity and sulphur. A low sulphur content will give a poor extraction, while a high sulphur content will form more pentavalent antimony with a consequential loss of deposition rate in the electrolytic cell.

The residue in No. 1 thickener is removed periodically and sent to a holding tank equipped with an agitator where No. 2 wash solution is added to bring the alkalinity to 100 g/1. Diluted material is then pumped to No. 2 thickener. Solution decanted from this unit is No. 1 wash. It contains 100 g/1 Na_2S and 25 to 30 g/1 antimony and is used in diluting the leaches. Thickened residue is removed periodically to holding tanks, followed by filtering in a 6-ft, 4-disk filter. Filter cake is repulped with hot water to 40 g/1 Na_2S and then filtered on an 8x8-ft drum filter. The treated cake is the final residue sent to a copper smelter, and the filtrate is wash No. 2 used to dilute the underflow from No. 1 thickener.

Filtering is not done continuously, because the hot residue from the filter oxidizes quite readily when stored in a bin and the evolution of SO_2 gas would be objectionable in the plant. Instead, the residue is held in agitated tanks until a shipment has accumulated at which time filtration is completed as quickly as possible. Thickeners are not used with continuous overflows, but the solution is decanted as needed. Pregnant solution from No. 1 thickener is sent to a storage tank ahead of the electrolytic cells. The tank is equipped with rakes to remove any solids that may be dumped there accidentally. Clarified pregnant solution containing 60 g/1 antimony goes to the electrolytic cells in batches as needed.

Electrolysis Is Complicated

Electrolysis of a sulphur-bearing solution is complicated. Neither Na_3SbS_3 nor Na_3SbS_4 ionize to an antimony ion. The current is carried instead by the ionization of Na_2S to $2Na^+$ and $S^=$. Sodium is deposited on the cathode which immediately reacts with water to liberate hydrogen. The hydrogen reduces the antimony to the metallic state on the cathode plate. Complicated as the reactions are, the net result is the concentration of sodium around the cathode and sulphur around the anode. Sulphur deposits out as elemental sulphur, or, if enough sodium hydroxide is present to dissolve the sulphur, it will oxidize to any one of its possible compounds characterized by sodium polysulphide, sodium thiosulphate, or sodium sulphate.

If electrolysis is carried on in an open cell the natural circulation will carry the polysulphide into contact with the metallic antimony on the cathode plates and the antimony will be redissolved or the polysulphide will be reduced, either action causing a loss of current efficiency. As the oxides of sulphur have no solvent power for antimony they cannot be allowed to build up in the circuit. By using a diaphragm to maintain separate anolyte and catholyte solutions one difficulty of employing a sulphur-bearing solution as an electrolyte is overcome.

Equipment used in the plant consists of 96 electrolytic cells arranged in two circuits of 48 cells each. The cells are further arranged in 8 double rows with the solution cascading through 6 cells. Feed to the cells, for both the anolyte and catholyte, is through orifices from a steady head tank to insure uniform flow at all times. Both anolyte and catholyte are circulated by pumps. Each cell contains 9 cathodes and 8 anodes spaced on 2½-in. centers, anode to cathode. Both are of mild steel, the anode being ⅛ in. thick and the cathode 3/16 in. thick. Cathodes have a submerged area of 3.33 sq ft per side. Current carried on the bus bar is 1500 amp, giving a current density of 28 amp per sq ft. There is no appreciable gassing at the cathode until the antimony has dropped to 10 g/1. Voltage varies between 2.5 to 3 v per cell.

Anodes are slightly smaller than the cathodes to lessen growth on the edges. Each anode is encased in an iron frame with sail cloth sides. The canvas sides keep the anolyte and catholyte solutions from mixing but do not impede the passage of the current. Anode baskets are connected together and to the adjoining cells by rubber hoses. The basket is constructed in such a manner that the anolyte circulates across the anode from bottom to top. Anolyte solution is made up from 30% barren catholyte and 70% sodium hydroxide. Barren catholyte is added for two reasons: (1) because the impurities are controlled by removing some catholyte from the circuit, and (2) because heavy gassing occurs at the anode unless some sulphur appears in the anolyte.

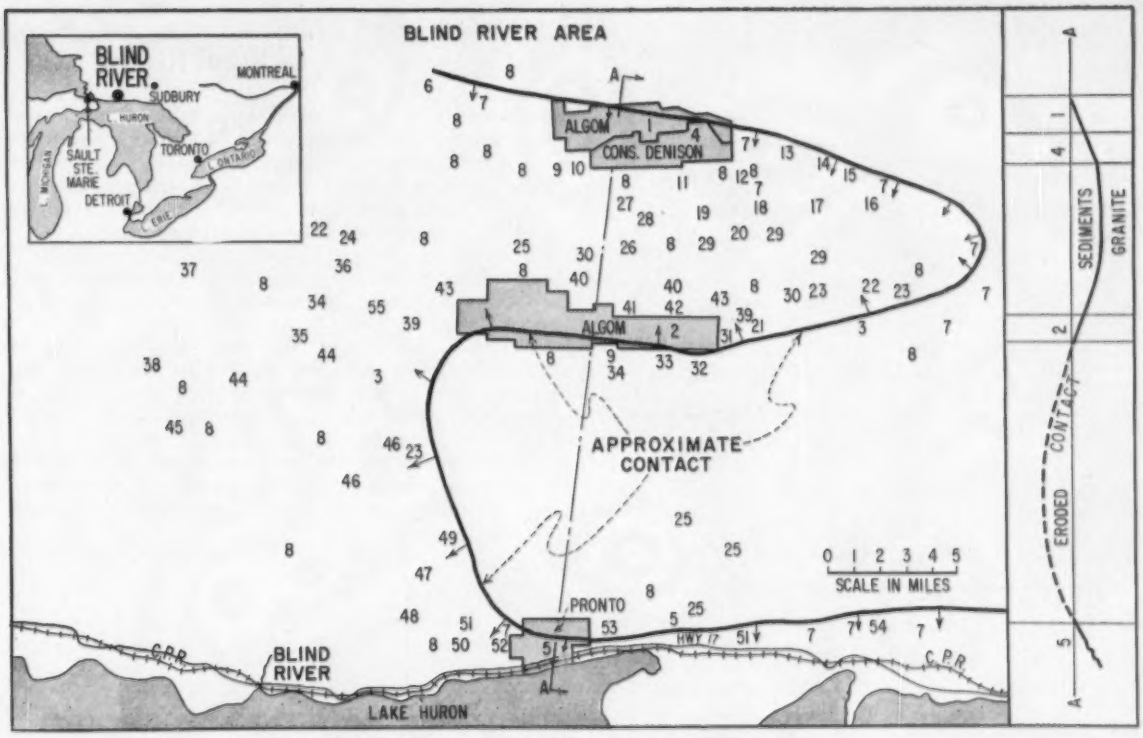
Each anolyte circuit contains about 15 volume tons of solution. The circuit is changed by withdrawing about 10 tons of solution and adding a like amount of fresh anolyte. The anolyte is added at 275 g/1 NaOH and is circulated through the cells until the alkalinity has dropped to 150 g/1 NaOH. Fresh anolyte contains 275 g/1 NaOH and 30 to 40 g/1 sulphide sulphur with very little oxide sulphur. By the time the anolyte is withdrawn the alkalinity has dropped to 135 g/1 NaOH while the total sulphur has increased to about 100 g/1 with only 10 to 20 g/1 of sulphide sulphur. This fouled anolyte is discarded.

Catholyte Is Fed in Batches

Each catholyte circuit contains about 45 tons of solution. The solution is added in batches of 30 tons with a like amount withdrawn. A portion of the barren catholyte is sent to anolyte makeup, the remainder to storage ahead of the leaches. Catholyte enters the circuit at 200 to 220 g/1 Na_2S, 100 to 110 g/1 sulphide sulphur, and 55 to 65 g/1 antimony. The solution is circulated through the cells until the predetermined antimony content has been reached. Barren catholyte is withdrawn at 280 to 300 g/1 Na_2S, 80 to 90 g/1 sulphide sulphur, and 10 g/1 antimony.

Cathode plates are pulled every 4 days. The deposited antimony is quite brittle and breaks free with light blows. Removed metal is washed in hot water to remove adhering solution. Owing to the high concentration of antimony and sodium sulphide in the solutions, the solutions are kept warm to prevent crystallization.

The author acknowledges with thanks the help given by R. D. Leisk, vice president and general manager, Sunshine Mining Co., in the preparation of the article.



Key to Company Locations in Blind River Area

1 Algom Uranium (Quirke)
2 Algom Uranium (Nordic)
3 Algom Uranium
4 Consolidated Denison
5 Pronto Uranium
6 Consolidated Orlac
7 Panel Consolidated
8 Stancan Uranium
9 Uranium King
10 McMarmac Red Lake
11 Spanish-American
12 Can-Met Explorations
13 Conecho Mines
14 Winora Gold Mines
15 Sand River Gold Mines
16 Bracemac Mines
17 San Antonio Gold Mines
18 Norgold
19 Lexindin
20 Nasco
21 Pardee Amalgamated
22 Picton Uranium
23 Magoma Mines
24 Brunette Porcupine
25 Normingo Mines
26 Pluton Uranium
27 New Delhi
28 Detta Minerals
29 Plum Uranium
30 Callinan Flin Flon
31 Abeta
32 Buckles Algoma
33 Geneva Lake Mines
34 Dominion Uranium
35 Anabar Mining
36 Maralgo Mines
37 Pylon Uranium
38 Matinenda Uranium
39 New Jersey Zinc Ltd.
40 Stanleigh Uranium
41 Milliken Lake
42 Lake Nordic Uranium
43 St. Mary's Uranium
44 Fano Uranium
45 Temple Gold Mines
46 Pickering Metals
47 Gwillim Lake Mines
48 New Kelore Mines
49 Cusco Mines
50 Blind River Uranium
51 Preston East Dome
52 Confederate Uranium
53 Pater Uranium
54 Peach Uranium
55 New Bristol Oils

Canada Taps Blind River's Uranium

BLIND RIVER, Ontario's bustling uranium camp, is moving toward production. In an atmosphere of intense exploration, full-scale drilling and weekly financial deals covering blocks of claims, Canadian miners are reaching out to tap an estimated 100-million ton orebody on the edge of the Canadian Shield.

The 100-million tons is an unofficial estimate; but already more than 25-million tons of ore have been delimited. At present some 50 diamond drills are working on the claims of more than 30 companies, tapping along the "Z"-shaped contact which is the major structural feature of the area. Veteran prospectors at the site have estimated that five to ten years' more drilling will be required before the ultimate tonnage in the region will be known.

Mill construction is in progress or planned on four properties with total capacity of 11,800 tpd. Contracts have been signed by two companies, Pronto Uranium Mines and Algom Uranium Mines, covering sale of $261-million worth of uranium oxide concentrates to Eldorado Mining & Refining Ltd., the government-owned company to which all uranium ores and concentrates must be sold.

Near Water, Rail and Road

Blind River uranium area is about midway between Sudbury and Sault Ste. Marie, on the Canadian Pacific Railway and highway 17, and north of Lake Huron's north channel.

Country has been prospected for base metals and gold, and sulphide showings were investigated in the mid-1920's, but no orebodies of importance were outlined. Following uranium discoveries on the east shore of Lake Superior in 1949, some prospectors examined old pits in Long Township and found radioactivity. Samples showed low uranium content and radioactivity was ascribed to thorium. Interest slackened.

Geologist Franc Joubin re-examined the showing again in 1953, and decided that the low thorium content indicated leaching of surface showings and that the radioactivity detected was deep seated. With Joseph H. J. Hirshhorn providing funds, Joubin drilled and found the ore. In the rush that followed, the entire 30x40-mile area was staked.

Pronto Uranium, initial Joubin-Hirshhorn venture and most advanced property, is rushing its 1,800-tpd mill to completion for September production. Algom, the Rio Tinto interest, is completing one shaft on its Quirke

Anomalies at Blind River

DEPARTMENT OF MINES of the Province of Ontario has published an aeromagnetic map of the sixteen townships of the Algoma district which includes Blind River and the townships west. Symbols show location of appearance of indicated radiometric anomalies. Anomalies are graded using the response experienced over larger lakes as standard. Survey was flown in February and March 1955. Maps are produced by Aeromagnetic Surveys, Ltd., and are available from the Publications Branch, Ontario Department of Mines.

Anomalies, which seem to follow the general trend of Blind River's famous "Z"-shaped contact, are numerically graded on the sixteen individual maps. 1 on the survey is "equal to water background;" 2 is "equal to twice water background" as registered on the plane's instruments.

Mining company in the area farthest west is Matinenda Uranium, which is drilling at the present time. Other operators in the district are watching Matinenda's progress. (See text.)

Lake group and sinking a second shaft at Nordic Lake. Mills will be built at both properties. Target at Quirke Lake is 3,000 tpd in mid-'56; at Nordic, early 1957, with a mill the same size.

Buckles Uranium reports indication of 486,500 tons (0.124% U_3O_8) up the dip of the formation from Algom's Nordic deposit. Consolidated Denison, with $22-million backing assured, plans a 4,000-tpd mill. Consolidated is sinking its first five-compartment shaft to 1700 ft.

Spanish-American and Can-Met Explorations are reported to have thick intersections of good grade uranium in first holes completed. Pardee Amalgamated has outlined a reported 2.3-million tons of 0.07% oxide on its Aquarius group, and Pater Uranium reports an indicated 328,000 tons averaging 1.53% copper and 0.11% cobalt.

Conglomerates Are the Keys

Generally, uranium values of the area have been located in a bed, or beds of conglomerates situated at or near the base of a sedimentary series which lies above an older granitic or volcanic basement. Conglomerates were overlain by other sediments, now partially removed by erosion. Contact zone, between sediments and granitic rocks, now appears at the surface in the shape of a rounded "Z." Upper and middle limbs form a syncline, plunging west, separated by sediments. Lower and middle limbs form an anticline, with granitic rocks exposed between them. North limb dips south, middle limb dips north and south limb dips south. Strike of limbs is approximately east-west. (See map.)

Bed of argillite about 200 ft thick occurs within the sediments and is about 200 ft above basement rock, separated from it by Mississagi quartzite interbedded with conglomerates. These beds carry the uranium values. Location of the main ore-making conglomerate below the argillite is not constant. At Pronto, on the south limb, it is a basal formation lying in contact with the granites. At Algom's Nordic (middle limb), it is about 20 ft above the contact; while at Algom's Quirke and Consolidated Denison (north limb) it has been found midway between the argillite and the basement.

It also appears that either a trough or basin within the contact—or as at Pronto, a series of ledges—has been necessary for deposition of the required thickness of conglomerate on the old erosional surface.

The ore-bearing conglomerate may prove to be easily followed visually. It is composed of closely packed, well worn quartz pebbles, 1- to 2-in. in diameter, in a matrix of sericite and chlorite with considerable sulphide mineralization. Uranium grade does not appear to have any relation to sulphide content of ore, yet sulphides appear necessary for the presence of uranium.

Values have been in brannerite, pitchblende and minor quantities of uraninite and thucolite. Sulphides are predominantly pyrite and/or pyrrhotite, chalcopyrite, galena and molybdenite. Very slight increases of thorium have been noted as one moves from south to north. Thorium content is low, amounting to maximum 1:4 parts uranium. Gold values have been reported, but no currently-planned mills are designed to recover it. It is expected that head sampling during initial milling will affect decisions on gold recovery.

Room and Pillar Methods

Average grade of bodies being readied for production is reported between 0.11% and 0.14% uranium oxide. Mining plans, mostly based on room and pillar methods using large scraper hoists or rubber-tired trackless equipment, have been laid out. Mill tails will be used as fill to allow recovery of pillars and to limit subsidence, permitting mining of secondary congomerate beds later. Lower milling costs through greater experience and improved research are expected to make much of the secondary ore reclassifiable. (See *E&MJ*, May 1955, p 75, for a discussion of reclassifying of ore reserves by Jesse C. Johnson, U.S. Atomic Energy Commission.)

Concentration of values across the Z-shaped structure is on a line between Pronto (south limb) through Buckles and Nordic (middle) to Consolidated Denison and Quirke (north limb). Southeast trend of values indicated on the north limb was believed verified by successful No. 1 hole at Can-Met Explorations. Reportedly, rich intersection obtained at Spanish-American, however, is located due south of Consolidated Denison, down the dip.

(*Continued on p 118*)

Companies Active at Blind River at Latest Reports

Any listing of companies active in the rapidly expanding Blind River area will necessarily be incomplete, but the following are known to be active, or planning work in the near future. Figures quoted are based on the most reliable information available and checked with official sources wherever possible.

Abeta Mining Corp.: Cut ore in the first two holes drilled on its recently acquired group of claims adjoining southeast of Algom Uranium's Nordic Lake property on the middle belt.

Algom Uranium Mines: One of Blind River's coming major producers. Building two 3,000-ton mills; one on Nordic Lake group where drilling indicated 6,171,000 tons averaging 0.113% uranium oxide, and one of the Quirke Lake group where reserves are calculated at 7,463,500 tons averaging 0.106%. Five-compartment shafts are being sunk at each property, with production to start at Quirke Lake in mid-1956, and at Nordic Lake in 1957.

Algom has contracted with Eldorado Mining & Refining Ltd. for sale of $206,910,000 worth of uranium oxide concentrates over a five-year period. Senior financing ($40-million) was provided by a deal with Rio Tinto through its Canadian subsidiary; Rio Tinto assumes management and becomes a major shareholder. Another major shareholder is Preston East Dome Mines, which holds 1,250,000 shares. Algom also holds two other groups, both with good potential.

Anabar Mining and Development Co.: Completed first drilling on its 30-claim group in the western section where basements were found at shallow depths. All holes cut low uranium values in conglomerate, and indicated a secondary valley in the basement floor. More drilling will see if depression has caused increased thickness and grade of conglomerate.

Blind River Uranium Mines: Drilling on the south belt, west of Pronto Uranium.

Bracemac Mines: New company drilling in the northeast part of the syncline. First results encouraging.

Brunette Porcupine Mines: Has 25 claims in the western portion of the syncline. Is drilling a joint deep drill hole with Picton Uranium Mines, adjoining, which cut over 225 ft of radioactive material, after completing earlier joint hole with Maralgo Uranium Mines that cut into a barren diabase dike. Property also has indications of copper.

Buckles Uranium Mines: Coming producer of moderate potential. Has outlined 486,500 tons averaging 0.124% uranium oxide on the up-dip structure south of Algom's Nordic Lake property. Has completed shaft to 77 ft. Ore will probably be mined in conjunction with the Algom operation and milled in the latter's plant.

Can-Met Explorations Ltd.: Completed two deep holes; good ore showing in each. This 15-claim group on the north contact, just west of Consolidated Denison, has $1.4-million in the bank.

Confederation Mining Corp.: Drilled seven holes on its group west of Pronto on the south belt. All cut radioactive conglomerates above basement rocks.

Consolidated Denison Mines: Could develop into the camp's biggest show. Widely spaced drilling has indicated ore averaging 0.142% uranium oxide with thickness of 12.1 ft over a length of nearly two miles and a width of 3,000 ft. Now engaged in fill-in drilling; has started a five-compartment exploration shaft to 1700 ft. Milling plans are being formulated on a 4,000-ton basis.

Denison property is on the south of Algom's Quirke Lake group, down dip and along strike on the north limb of the synclinal structure, consisting of 80 claims. Company has $2.5-million cash and has arranged for $22-million of financing through sale of bonds and debentures.

Cusco Mines: Formerly Goodfish Mining Co.; has a drill at work on its ground near the nose of the Blind River anticline.

Dominion Uranium Mines: With a group several miles west of Algom's Nordic group, company is continuing a shallow drilling program. Some ten holes completed to date indicated radioactive conglomerates, but below ore grade.

Fano Uranium: New company with large holdings to the west of Algom's Quirke Lake group, miles from the surface exposure of the contact but located where the Mississagi sediments are known to be nearly flat and the basement rocks may be at shallow depths. Still drilling.

Geneva Lake Mines: Adjoins Buckles Uranium to the west, south of Algom's Nordic show. Limited drilling indicated that only a small corner of the contact zone is included in the 18 claims, and further chances of adding to tonnage appear slim.

Lake Nordic Uranium Mines: Another in the Joubin-Hirshhorn stable. Has cut good-looking material of probable ore grade in two deep holes (below 2,000 ft) on the down-dip extension of Algom Uranium's Nordic ore bed. Two machines are drilling to extend the conglomerates down the dip, while two others are drilling jointly with Milliken Lake Mines and St. Mary's Uranium Mines on Lake Nordic's boundaries.

Lexindin Gold Mines: Has likely ground in the center of the syncline between north and middle limbs. Drilling a deep hole, scheduled to go to 3500 ft.

Matinenda Uranium Mines: Prospect company with 150 claims about 17 miles west of the Algom Nordic group. Drilling on a series of holes designed to test structure in this unknown area, where basement rocks are expected to be anywhere from 1500 ft to 2,000 ft below surface. Several radioactive bands of conglomerates have been cut. Matinenda is pioneering in the western region, and its results wil be significant.

McMarmac Red Lake Gold Mines: Drilled three shallow holes on its 18-claim property west of Consolidated Denison in earlier work; now working on a deep vertical hole.

Milliken Lake Uranium Mines: Drilling its second hole jointly with Lake Nordic Uranium in an attempt to cut the down-dipping Algom conglomerate to the north of its Nordic property. First hole drilled was abandoned in diabase.

Nasco Cobalt Silver Mines: Drilling a deep hole in the center of the syncline; at latest had passed 3200 ft with formations occurring in text book fashion. Conglomerates, if present, will be at considerable depth.

New Jersey Zinc Exploration (Canada) Ltd.: American company's Canadian subsidiary has optioned the properties of Gui-Por, Big Game, and Moon Lake to the west of Algom (Nordic) and is using five machines in a large scale drilling effort. Holds option, too, on a Panel Consolidated group to the east of Algom (Nordic), where two drills are at work.

Norgold Mines: Another company with prospect ground in the center of the syncline, with a deep vertical hole drilling. Favorable conglomerates are anticipated at great depths here, too; possibly as deep as 3500 to 4,000 ft.

Panel Consolidated Mines: Company formed by the Hirshhorn interests to acquire various groups of claims along the contact zone. Strongly financed, Panel is drilling on a group east of Algom Uranium's Quirke Lake property, and plans work on other groups during the coming summer. All groups are along the Z-shaped structure.

Pardee Amalgamated Uranium Mines: Formed as a merger of 14 idle Hirshhorn companies, most of which had holdings in Blind River, as well as in other parts of Canada. Drilling now on the Aquarius group west of Algom's Nordic property, where work so far has indicated 2.3-million tons averaging 0.07% uranium oxide.

Pater Uranium Mines: Unique—with an indicated 328,000 tons averaging 1.53% copper and 0.11% cobalt on the south limb of the syncline. Continuing deep drilling program.

Peerless Uranium Mining Corp.: Has 18 claims at the southwest corner of Algom's Nordic group, with low uranium values cut in eight holes. Drilling on a new five-claim, some distance to the west.

Pickering Metal Mines: Has started to drill Emerald Lake group in the area west of the nose of the anticline. Holds a second group 1½ miles to the northeast.

Picton Uranium Mines: Drilling to the west of the syncline's center, putting down a joint boundary hole with Brunette Porcupine Mines. Depth objective is 2,000 ft. Also has a group in the eastern part of the syncline, and is starting drilling there, too.

Preston East Dome Mines: Long a successful gold producer in Porcupine, Preston hit the exploration jackpot when, in 1953, it went on the first Blind River staking. Secured four big and likely groups, two of which became Algom Uranium Mines, of which Preston, as vendor, became the biggest single shareholder. Still has two big groups to explore.

Pronto Uranium Mines: Pioneer Joubin-Hirshhorn endeavor; slated to be Blind River's first producer, with an 1,800-ton mill designed for production next September. Pronto, on the south-dipping south limb of the Z-shaped structure, has in excess of 3-million tons averaging 0.13% uranium oxide. Pronto has been financed to production by sale of $6-million debentures; controlling interest is held by Peach Uranium Mines.

Pylon Uranium Mines: Newcomer to Blind River from Beaverlodge, Pylon is drilling a large group to the west of the middle belt.

Roche Long Lac Gold Mines: Company with interests in various camps; acquired Blind River ground last year and has drilled two deep holes on 18-claim group on the north limb about a mile east of the Denison ground. Initial results gave only moderate encouragement. A third deep hole is in progress.

San Antonio Gold Mines: Long established Manitoba gold producer, with claims southeast of Consolidated Denison. First deep hole encountered no ore; a second is being drilled. Structure is favorable.

Sand River Gold Mines: An old company for which Blind River has brought new interest. Holds a group adjoining the San Antonio ground on the north; shallow holes gave some encouragement, and a deep hole is now planned, to be drilled jointly with Winora Gold Mines on their boundary.

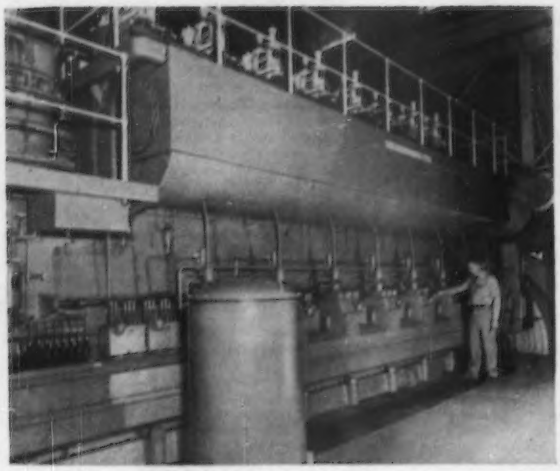
Stancan Uranium Mines: Delaware corporation featuring a large exploration staff, complete with aircraft. Holds 1,200 claims in several groups staked, purchased, or optioned along and within the contact zone. Several groups are optioned from Zenmac Metal Mines, which retains a vendor interest. Stancan is drilling a group south of Consolidated Denison, and one between Can-Met and Spanish American Mines on the north belt; and has a second machine at work on a large claim holding in the near center of the syncline. Accelerated program is planned for the coming season.

St. Mary's Uranium Mines: With 28 claims in the down-dip area north of Algom Uranium's Nordic ground, St. Mary's is drilling a deep hole jointly with Lake Nordic Uranium. Has a second group several miles west on which first drilling has been disappointing.

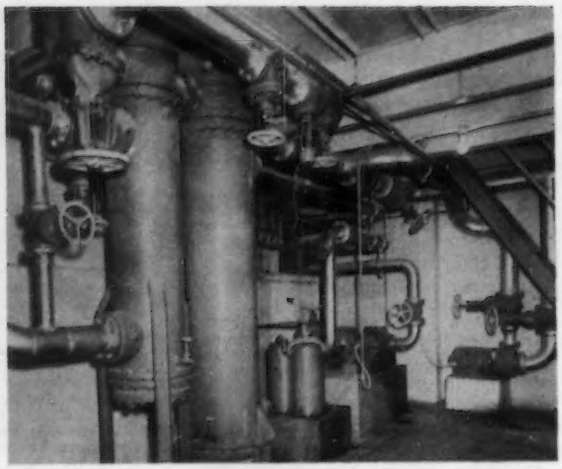
Uranium King Corp.: Holds several groups totalling 50 claims in the area. Currently engaged in drilling a group to the west of McMarmac on the north belt.

No attempt has been made in the above listing to include all the companies which hold ground in the Blind River area, names being limited to those concerning which official information could be had. Many other companies hold ground, or are acquiring interests, some of them with work planned or perhaps already under way.

In the syncline area south of Consolidated Denison, for instance, activities were being planned at latest report by **Harrison Minerals, New Delhi Mines, Glenora Gold Mines,** and **Detta Minerals.** Other companies not listed above, which are reported drilling or planning work for the coming season in various parts of the camp include **Gwillam Lake, Duvex Oils & Mines, Consolidated Orlac Mines, Magoma Mines, Thorncrest Explorations Ltd., Callinan Flin Flon Mines, Vite Uranium, Stanleigh Uranium, Plum Uranium, New Bristol Oils,** and various others.



LARGEST DUAFUEL ENGINE at Potash Company of America's plant is this 3400-hp Nordberg installed in December 1951.



AUXILIARY EQUIPMENT includes lube cooler and heat exchanger, strainer and lube pump. See Table 2.

How Two-Fuel Engines Perform

IN THE OPERATION of its mines and mill at Carlsbad, N. M., Potash Company of America consumes almost 70 million kwh of electricity annually. Most of this power is supplied by PCA's own plant consisting of eight engines with a total sea level rating of 13,300 hp. This output is supplemented by purchased power (23% of total power demand).

More than 76% of the total power requirement is supplied by six Nordberg Duafuel engines which operate better than 98.6% of the time.

Plant Growth

First of the plant's six Nordberg engines, installed in 1936 after original plant had started, was a 750-hp mechanical-injection diesel. In 1937, the company purchased a 1500-hp air-injection engine and, two years later, another identical unit. With cheap natural gas available, PCA in 1940 converted these units to dual-fuel operation, burning gas admitted to the cylinders at high pressure with a small quantity of pilot oil to initiate combustion.

Growing demand for power dictated the addition of a 2400-hp gas-burning Nordberg diesel in 1941 with another identical dual-fuel unit installed the following year.

Newest and largest engine in the plant is the 3400-hp Nordberg gas-burning diesel, a unit with 8 cylinders of 21½-in. bore and 31-in. stroke, rated at 225 rpm. (All engines in the plant are derated about 8% at the plant elevation of 3,265 ft.) The big engine went into service in December 1951, giving the company six Nordberg gas-burning engines with combined capacity of 11,000 hp at the plant's altitude. In the year ending June 30, 1954, the plant generated 53,837,700 kwh, of which the Nordberg units produced 53,572,900 kw hr. Table 1 summarizes operating data.

All six engines were in virtually continuous operation, running an aggregate total of 51,855 hours, actually 98.6% of the time. Five of the six Duafuel engines have been in heavy-duty operation for periods of 12 to 18 years.

Load

Engines operate at an average load of about 80%, but this does not mean that the load holds steady at that comfortable level. Large motors are always starting and stopping, picking up or dropping their load. Thus, the average load for the year was 6,145 kw, but hourly peaks ran to 7,260 kw, and momentary peaks to a lofty 11,960 kw.

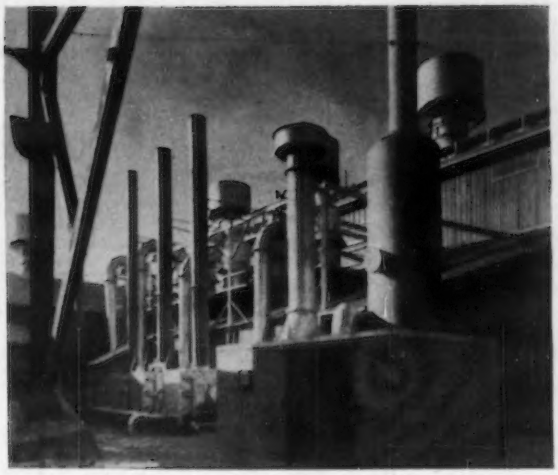
PCA derives one additional dividend from operation of its power plant. Exhaust gases from all but the latest Nordberg pass through waste heat boilers where they heat water used in potash refining.

Natural gas, the plant's principal fuel, comes in at 35 psig, is metered

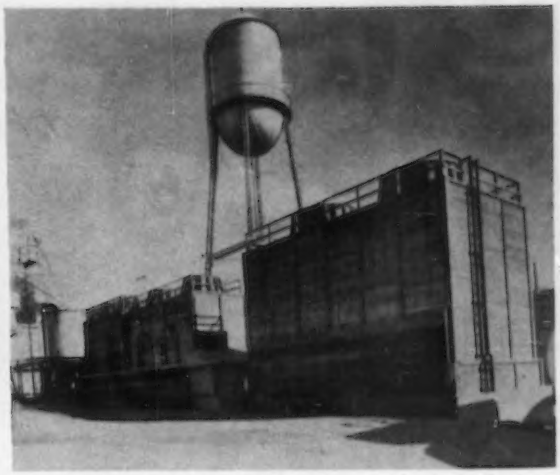
TABLE 1: Power Plant Operating Data July 1953—June 1954

Potash Company of America, Carlsbad, N. M.

KILOWATT-HOURS GENERATED	
Duafuel Engines	53,572,900
Oil Engines	264,800
Total	53,837,700
PLANT LOAD	
Average (kw)	6,145
Hourly Peak (kw)	7,260
Momentary Peak (kw)	11,960
FUEL CONSUMED	
Natural Gas (MCF)	605,247
Cu ft Gas per kwh	11.29
Pilot Oil (Gal)	229,583
Gal Pilot Oil per kwh	0.0042
Diesel Fuel (Gal)	22,978
Kwh per Gal Fuel	11.52



ENGINE AIR for big Nordberg unit is drawn through self-cleaning American Multi-Duty air filter in concrete housing.



COOLING WATER for entire 13,300-hp plant is handled in these three Marley induced draft cooling towers.

in Potash Power Plant

and then regulated to 12 psig. A 3-stage compressor driven off the engine crankshaft raises it to 1,150 psig for injection into the cylinders. There is an individual meter and a temperature gage on gas for each engine. Fuel oil (27-gravity) used as pilot oil is brought in by truck and stored in two tanks with combined capacity of 50,000 gal. Another two tanks provide 40,000 gal storage for the 22-gravity fuel oil used in the oil-burning diesels. All four tanks are fitted with heating coils through which engine jacket water is circulated. From storage, fuel oil is transferred by a pair of motor-driven centrifugal pumps to a centrifuge, then through duplex waste-packed filters to an overhead supply tank from which it flows by gravity to the engines.

Cooling

Cooling water for all but the newest engine is circulated by six motor-driven centrifugal pumps through engine jackets and coils in two induced draft cooling towers. It was found more convenient to tie the big engine in with the lube cooling system. A pair of motor-driven centrifugals pumps water through oil coolers for all the engines, a heat exchanger serving the big engine, and a third induced-draft tower. Water in a large surge tank floats on the suction of the circulating pumps providing a thermal siphon effect and reducing power requirements.

Lubrication

Lubricating oil for each of the Nordbergs is circulated under pressure to the bearings by an engine-driven pump. A motor-driven, before-and-after pump is arranged to start automatically if the main lube pump fails. Besides a full-flow strainer, lube is cleaned continuously in an activated clay purifier, which draws some oil from the pressure side of the strainer, cleans it and returns it to the sump. Lube is supplied to the cylinders by mechanical lubricators, an individual unit for each cylinder in the case of the big Nordbergs.

Scavenging

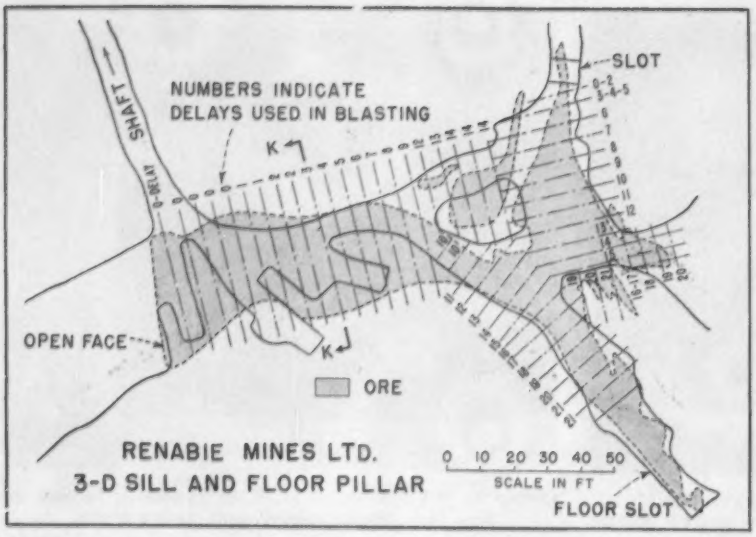
Scavenging air for the big two-cycle engine is drawn through an automatic self-cleaning filter to a 15,700 cfm blower which supplies air to the intake header. The blower is driven by a 300-hp motor powered directly from the generator of the engine served.

To keep the engines in condition to meet the normal heavy demands, PCA operating engineers perform scheduled preventive maintenance. But obviously, this maintenance work cannot keep the engines out of service many hours in a year, and the record shows that it keeps them running more than 98.6% of the time.

TABLE 2: Principal Equipment Serving 3400-hp Nordberg Duafuel Engine

Engine
Generator
Governor
Blower
Air filter
Fuel oil centrifuge
Fuel filters
Pilot oil pumps
Gas meters
Gas temperature gage
Auxiliary lube pump
Cylinder lubricators
Lube cooler
Lube purifier
Cooling water pumps
Heat exchanger
Cooling tower
Exhaust snubber
Lube strainer*
Gage board*
Alarm system
Exhaust pyrometer
Gages

* Equipment made by Nordberg Mfg. Co. For manufacturers of other items see *E&MJ* Mining Guidebook, Buyers Guide, Mid-March 1955.



HOW LONG-HOLE BLASTING RINGS are laid out to allow for 5-ft burden between rings, and 6 ft between holes to break approximately 2.5 tons per ft drilled.

Table 1. Equipment Performance Data

Footage drilled to Dec. 31, 1954	21,386
Total drill shifts	225
Footage per drill shift	95
Average footage per bit	133
Average footage per rod	510
Average footage per adapter	1,336
Average footage per "O" ring shank	1,645
Average footage per coupling	221

No allowance has been made for equipment still in use at the end of period.

Table 2. Costs

Total footage drilled... 21,386
Tons broken and drilled off 44,575
Tons per ft drilled 2.08

	Cost per ft.	Cost per ton
Bits	$0.176	$0.084
Couplings	0.025	0.012
Bit adapters	0.007	0.003
"O" ring shanks	0.010	0.005
Rods	0.035	0.017
Direct labor charges	0.263	0.126
Drill repairs and maintenance	0.044	0.025
Misc. supplies and services	0.058	0.027
Total cost	$0.618	$0.299

Renabie Long-Hole Drilling Campaign

P. S. CROSS
Renabie Mines, Ltd.
Ontario, Canada

***E&MJ* readers are familiar with P. S. Cross' ability to present practical mining articles. (Machine Loading at Renabie Mines, *E&MJ*, Jan. 1954). In this article Mr. Cross presents information that is rare in modern mining articles—costs!**

IN DECEMBER 1953, the long blasthole method of recovering stope sills and floor pillars was adopted at Renabie Mines Limited. From this date to December 31, 1954, 21,386 ft of long-hole drilling has been completed making available 44,575 tons of ore. Sufficient work has now been completed to give accurate costs and performance data.

Shape of Orebodies

Orebodies at Renabie vary in width from narrow quartz veins of 5 ft to large irregular shaped quartz zones from 20 to 100 ft or more. Lengths vary from 30 ft for the narrow veins to 300 ft for the large orebodies. While the vein type deposit has a uniform strike, the large bodies are of irregular strike and vary considerably in size and shape from level to level. The dip, however, is generally constant for both types of deposits and varies from 55 to 65 deg to the south. Plunge is consistent at 60 deg to the west.

Ore zones, of which there are 11 to date, are of the quartz replacement type in large shear zones developed in Algoman granite gneiss along the foot and hanging wall sides of major faults. No evidence has been found of major movement along these faults.

Mining Methods

Ore at Renabie is mined by the shrinkage method with mucking machine drawpoints. Stope preparation consisting of loader drifts, boxhole raises and coning, results in a stope sill about 20 ft in thickness. A floor pillar of 15 to 20 ft, depending upon the width of the ore zone, is left between the stope below and the level. This results in some 40 ft of ore being tied up in the stope sill and floor pillar on each level over widths varying up to 100 ft or more.

As large sills and floor pillars cannot be mined by standard stoping methods, blasthole ring drilling is utilized from the level. Much thinner sills and floor pillars are left in the short, narrow stopes and these are removed with conventional drilling equipment working from the muck in the stope below, if available, or by benching and back slashing from the level.

Long-Hole Equipment

As the ore is 100% quartz and very abrasive, high bit cost prevents use of diamond drills for long-hole drilling. The machine selected for the job was a 4-in. G-D SFH-99 long-hole machine with underslung power feed and clamp-type adjustable rod centralizers. The underslung power feed permits the use of a 4-ft change in a 7x7-ft drift. The machine has a 4-ft change aluminum shell and is equipped with reverse rotation which simplifies rod breaking. An "O" ring seal shank is standard in this machine and eliminates the water swivel. Air can be introduced to the water to clear sludge easily from long holes.

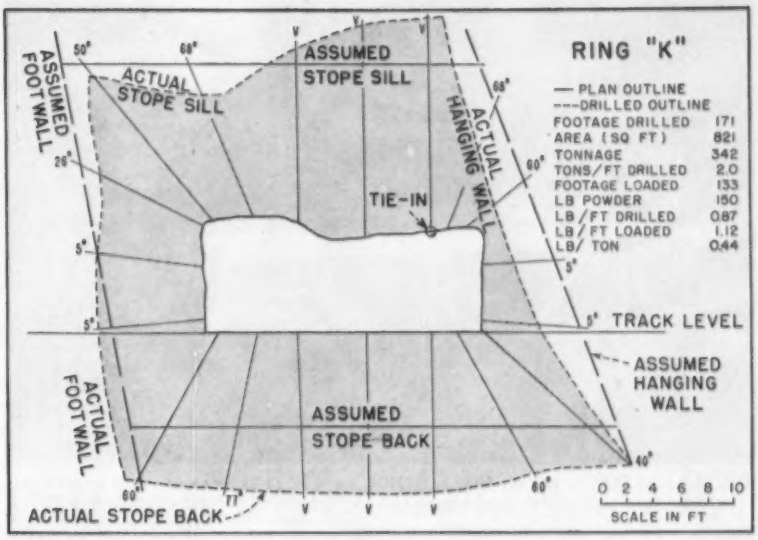
Rods used are in 3- and 4-ft lengths. They are 1-in. hexagonal tool steel with reverse buttress thread. The couplings are 4½ in. long with an outside diameter of 1¾ in. and are case hardened. Bits used are Timken 2⅛-in. TC non-squaring with medium-grade tungsten-carbide inserts. They have a standard lamp socket thread, and are fitted to the rods by means of a bit adapter. Standard column bars and arms are used to set up the machine. Equipment performance data are given in Table 1.

Table 3. Summary of 3-D Sill and Floor Pillar Blast

Total footage drilled	7,327
Machine shifts	86
Manshifts	172
Tons broken	12,500
Tons per ft drilled	1.72
Ft drilled per machine shift	84.20
Tons broken per manshift	72.60
No. of holes drilled	449
Average length of holes	16.10
Timber blasted	84
Lb of powder used	7,500
Lb of powder per ft of hole drilled	1.03
Lb of powder per ton broken	0.60
No. of cap series	13
Calculated resistance of circuit	5.03 ohms
Measured resistance of circuit	4.50 ohms
Required amp	70
Actual amp	103
Actual amp per series	7.50

Cost Summary of 3-D Sill and Floor Pillar Blast
Tons broken 12,500

Drilling labor	$0.1606
Drilling supplies	0.1996
Drill repairs and labor	0.0024
Loading labor	0.0258
Blasting supplies	0.1581
Total cost per ton broken	$0.5465



REFER TO PLAN (LEFT) to find location of section K showing position of long drill holes extending to limits of ore in the sill, floor pillar and walls of the drift.

Yields Useful Operating Cost Data

Engineering Layouts

Drilling layouts by the engineering department use the level plans, sill outline of the stope above the level and the outline of the last horizontal cut in the stope below the level. Rings are laid out with 5 ft burden between the rings and 6 ft between the holes to give about 2.5 tons per ft of hole drilled. This figure decreases slightly in the over-all average due to the necessity of fanning holes. The maximum ground permitted at the extremity of the fan holes is 10 ft.

A plan for each ring showing the length, dip and location of each hole is prepared for the drill crew. Each ring is painted on the walls of the drift and a line between survey stations in the back of the drift is used as a tie-in. Where length of hole is not shown on the plan, the hole is drilled until it hits waste or breaks into the stope below or above. Where possible, all holes are drilled to break through. This makes tonnage calculations more accurate and also gives good drainage for the drill water and sludge through the drift floor.

The drill runner reports the drilled length of each hole on his plan and any additional holes that might be drilled. The plans of completed blasthole rings are returned to the engineering office.

The slot through the floor pillar is usually established at any one of several stope raises from the stope below. Extra holes are located here to insure a clean break of the slot. The slot through the stope sill can be started at any of the boxholes through the stope sill.

Bonus System

All long-hole drilling is done on one shift using one machine. The drill crew consists of a runner and a helper, the latter doing the bit sharpening at the drill site using a portable air grinder equipped with a 6x1-in. flat-faced medium-grit grinding stone. The work is on contract and the crew is paid 15c per ft over a base footage of 60 ft per drill shift with the runner receiving 60% and the helper 40% of the total bonus earned. All moving and setting-up time is on contract.

A 2½-in. inside diameter pipe, 16 to 20 in. long, is used as a casing for all holes drilled in the drift floor. Collaring is done with a 3-in. Timken steel bit. Bits are sharpened by grinding. The casing hole is usually drilled 6 to 10 in. into solid rock. Casing pipe is placed in the hole and packed with rags around the outside.

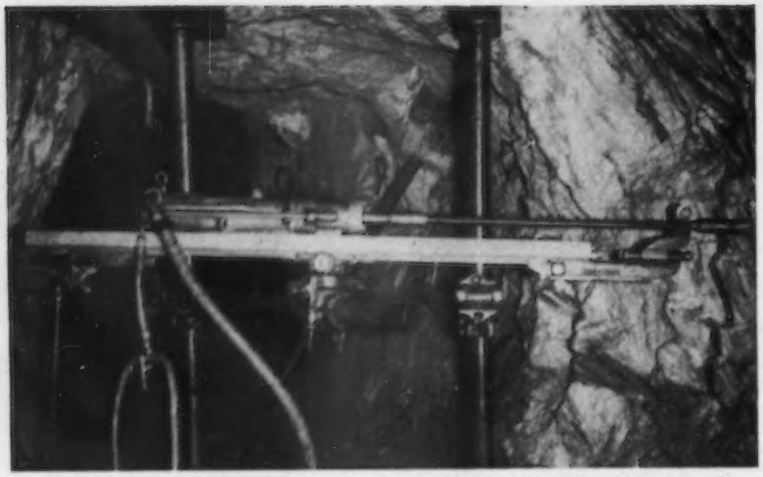
All holes in the drift walls and back are collared with a 2¼-in. Timken steel bit. The 2⅛-in. Timken tungsten-carbide tipped bits are run 8 ft before resharpening. Runs in excess of this cause extensive dulling, resulting in high carbide loss during sharpening. Rods in 4- and 3-ft lengths are used. The coupled joints are broken using an 18-in. pipe wrench and the reverse rotation of the machine. In up and down holes, the coupling at which the rods are to be broken rests on the centralizer and prevents the rods from slipping.

Length of the holes drilled varies from 10 to 50 ft, and drilling speed between 8 and 10 in. per min. The greatest footage drilled in one shift was 149 ft, while the average is around 95 ft. The runner is instructed to drill extra holes if more quartz is encountered than anticipated.

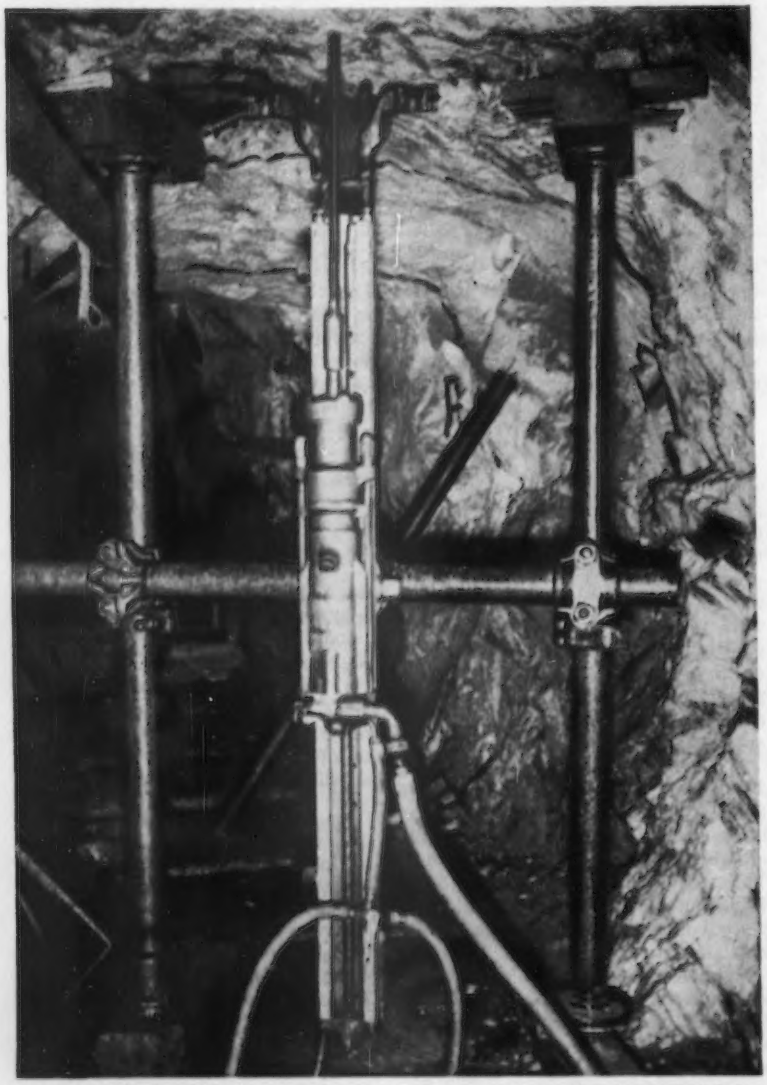
Costs as outlined in Table 2 are based on a 12½-month period ending Dec. 31, 1954 during which the drill was in operation 225 shifts. No allowance has been made in this cost summary for equipment such as bits, rods, etc., still in use at the end of the period.

Blasting with Fast Delays

All blasting is done electrically using short period delay caps from 1 to 21 with 10-ft leads. Powder used is 60% Giant Gelatin in cartridge size 1¼x16 in. Holes of even burden are column loaded to within 2 ft of the collars. The primer is placed 5 to 6 ft from the collar with a minimum of two sticks on top. In the fanned holes the toes are loaded solid and spacers 1½x12 in. are used near the collars where the burden between the holes



DRILLS USED FOR LONG-HOLE WORK are 4-in. G-D machines with underslung power feed and clamp-type adjustable rod centralizers. Steel change is 4 ft.



THE SAME MACHINE mounted on twin columns and crossbar for vertical holes. Drills are equipped with aluminum shell and reverse rotation to speed rod changes.

is light. Holes broken through into the stope below are plugged with a short piece of wood and a cord extending to the collar of the hole. Up holes into the stope above are usually plugged with muck from the stope sill.

All holes in a complete ring are loaded with the same delay. In a partial ring, where the drilling drift has been along the footwall or hangwall of the ore and the ring is not completely around the drift, the outside holes are fired at a later delay to insure a clean break along the walls. Blasting retreats in both directions from a centrally located slot through the sill and floor pillar.

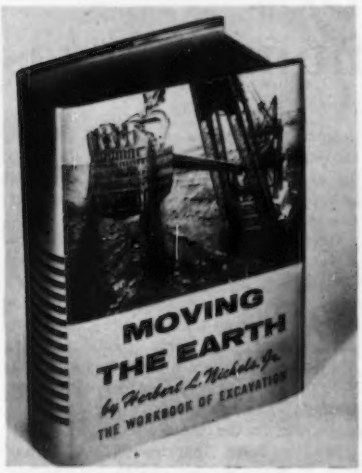
Caps are connected in series in parallel, 40 caps to a series. Two-conductor No. 10 cabtire wire is used as a lead from the power source, and two strands of single-conductor No. 12 wire are used through the blast area to which the cap series is attached. Each series is tested for breaks and current leakage prior to hooking up to the leads. A Canadian Industries Limited voltometer is used for these purposes. The entire circuit is tested before connecting to the power source. The blast is initiated by 550 v taken from the main mine power feed junction box at the level station and is fired through a magnetic switch from a blasting switch on the surface. All large blasts are fired at the end of the shift when all personnel are out of the mine. Table 3 gives a summary of a sill and floor pillar blast. The blast was laid out on a 5x5-ft spacing to yield 2 tons per ft drilled.

Results Achieved

This method of stope sill and floor pillar recovery, although no cheaper than standard stoping methods, permits complete recovery of all ore tied up which cannot be mined from below the level, and at the same time, affords maximum safety. Although the burden is heavier on the holes than in normal stoping operations, the heavy charges of explosives employed and the numerous slips in the quartz ore itself have resulted in muck size not in excess of that obtained in normal stoping work. Some large slough, however, comes down off the exposed hanging wall. As it is mostly waste and is usually on top of the broken ore, it is left in the slope and presents no problem. In all, Renabie has been satisfied with this method of stope sill and floor pillar removal.

The author wishes to express his appreciation to A. A. McCloskey, mine manager, for his helpful comments and suggestions as well as permission to publish the data contained in this article.

NEW BOOKS



Moving The Earth, Herbert L. Nichols, Jr. 1280 pp and 1266 illustrations cover the whole field of earthmoving and should be of interest to miners, new and old. The first section of the book will provide you with plenty of practical information on every phase of mining. The second section is a detailed discussion of most of the earthmoving machinery on the market. Safety and accident prevention are stressed throughout the book. It was easy to read in that "how-to-do" style. Published by North Castle Books, 212 Bedford Road, Greenwich, Conn. Price $15.00.

The Peaks of Lyell, Geoffrey Blainey. Life and death for mine and miner in the Tasmania copper fields. A history of "Coronado's Children" in their search for bonanza in the rugged mountains of Lyell, Owen and Huxley. You'll find it hard to put aside. Published by Melbourne University Press. Price 30s. In the U. S. by Cambridge University Press, 32 E. 57th St., N.Y. 22, N.Y. 302 pp. Price $5.00.

Electrons Atoms Metals and Alloys, W. Hume-Rothery. The author takes a cue from Aristotle and presents the atomic theory in dialogue. The book covers the field from atom to fission with suggestions for further reading at the end of each chapter. Published by Louis Cassier Co., Ltd. and distributed by Iliffe & Sons in London. In the U. S. by Philosophical Library, Inc., E. 42nd St., N. Y. 16, N. Y. 379 pp. Price $10.00.

Geology In Engineering, J. R. Schultz and A. B. Cleaves, geologists who can write about the subject with a minimum of tongue-twisters and jaw-breakers. A systematic account of geology from the civil engineering viewpoint. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, N. Y. 16, N. Y. 559 pp. Price $8.75.

Turboblowers, A. J. Stepanoff. Published by John Wiley & Sons. 371 pp. Price $8.00.

Materials of Construction, A. P. Mills, H. W. Hayward, and L. F. Rader. Published by John Wiley & Sons. 6th Edition. 622 pp. Price $7.50.

Plant and Process Ventilation, W. C. L. Hemeon. Published by Industrial Press. 429 pp. Price $9.00.

Transform Calculus, E. J. Scott. Published by Harper & Bros. 328 pp. Price $7.50.

Legal Guide for California Prospectors and Miners, L. A. Norman & staff. A reprint of their pamphlet issued by Division of Mines, Ferry Bldg., San Francisco 11, Calif. Price 25c.

Mines Register (25th edition). Published by National Business Press, Inc., 425 W. 25th St., N. Y.

Practical Guide for Prospectors and Small-Mine Operators in Montana. Published by Montana Bureau of Mines & Geology, Montana School of Mines, Butte, Montana. Price $1.00.

Titanium in Iron and Steel. The third publication in the Alloys of Iron Research New Monographs Series. Written by G. F. Comstock and published by John Wiley & Sons. Price $6.00.

Geological Society of America has issued Part 4 of its bulletin Bibliography and Index of Literature on Uranium and Thorium and Radioactive Occurrences in the United States. This section covers the states of Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota and Texas. Written by Margaret Cooper for the Atomic Energy Commission. Price 50c. Address 419 W. 117 St., N. Y. 27, N. Y.

A Treatise on Applied Hydraulics. New fourth edition by Herbert Addison. Published by John Wiley & Sons, Inc. Price $9.50.

Chemical Process Principles. Part I—Material and Energy Balances. Second edition by Olaf Hougen, Kenneth Watson, and Roland Ragatz. Published by John Wiley & Sons, Inc. 540 pp. Price $8.50.

Cobalt in Canada. By R. J. Jones. A valuable reference booklet covering cobalt ores and minerals Canadian mine production, Canadian occurrences, world mine production of cobalt, metallurgy including up-to-date flowsheets, consumption and use of cobalt, foreign trade, international controls. Published by the Canada Department of Mines and Technical Surveys, Mines Branch, Ottawa, Canada. 96 pp. Price $1.50.

Nuclear Geology. Edited by Henry Faul. Twenty six contributing authors who are specialists in various phases of atomic energy sciences provide the information which makes this book a valuable reference for anyone who wants to study the impact of the Atomic Age on the profession of mining and geologic engineering. Published by John Wiley & Sons, Inc. 414 pp. Price $7.00.

Development of Mineral Resources in Asia and the Far East. A United Nations, Department of Economic Affairs, Report. Available from International Documents Service, Columbia University Press, 2960 Broadway, New York 27, N.Y. Pp 366. Price $3.50.

Alternating Current Machines. Third Edition. By A. F. Puchstein, T. C. Lloyd, and A. G. Conrad. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Pp 721. Price $8.50

Plant Layout. By Randolph W. Mallick, Executive Staff Engineer, Westinghouse Electric Corp., and Armand T. Gandreau, Management Consultant, Pittsburgh, Pa. Plant layout planning and practice are covered in this book based on many years of practical experience of the authors. Materials handling is one of the important industrial processes emphasized. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Pp 391. Price $7.50

The following publications are available from the State of California Department of Natural Resources, Division of Mines, Ferry Bldg., San Francisco 11, Calif. Prices for these publications were not specified.

Bulletin 164, Geology of the Eel River Valley Area, Humboldt County, California. By Burdette A. Ogle. Pp 128, plus maps, figures.

Bulletin 168, Geology of the Breckenridge Mountain Quadrangle, California. By T. W. Dibblee, Jr., and Charles W. Chesterman. Pp 56, plus figures, plates, maps.

Bulletin 166, Geology of Lower Lake Quadrangle, California. By James A. Brice, containing a section on economic geology by Mr. Brice and J. Grant Goodwin. Pp 72, plus maps, plates.

Bulletin 167, Geology of the Ortigalita Peak Quadrangle, California. By Louis I. Briggs, Jr. Pp 61, plus plates, maps.

The following publications are available from the State of California Department of Natural Resources, Division of Mines, Ferry Bldg., San Francisco 11, Calif., at the prices specified.

Special Report 33, Geology of the Griffith Park Area, Los Angeles County, California. By George J. Neuerburg. Pp 29, plus plates, maps, figures. Price 50c.

Special Report 35, Tungsten Deposits of Madera, Fresno and Tulare Counties, California. By Konrad B. Krauskopf, Pp. 83, plus figures, maps. Price $1.25.

Special Report 36, Geology of the Palen Mountains Gypsum Deposit, Riverside County, California. By Richard A. Hoppin. Pp 25, plus plate, figures, map. Price 75c.

Subcommittee Hears Aluminum Charges

House Group Calls Extruders, Producers On Non-Availability; Hearings to Continue

ALUMINUM REGAINED the spotlight in Washington in late May, as the Yates Subcommittee on Minerals and Raw Materials under the House Select Committee on Small Business began hearings on short supplies.

Charges which produced the hearings are not new—complaints by the non-integrated consumers that their supplies from the "Big Three" producers, Alcoa, Kaiser and Reynolds, are not sufficient to meet their needs. Another catalyst in the situation has been the record demand for aluminum during the first half of 1955, wiping out inventories on hand from late 1954, which were already low because of uncertain sales last year.

After hearings were completed in May, to receive and consider more testimony and statistics from private companies and Government sources, the Subcommittee plans to reconvene in June for more hearings.

Representative Yates (D-Ill.), chairman of the Subcommittee, outlined five possible lines of investigation and possible action he hoped to take:

(1) The possibility of a new round—the third—of aluminum expansion goals;

(2) Suggested continuation of the Justice Department's jurisdiction over Alcoa, which would otherwise cease in January 1956;

(3) Establishing tighter control of contracts between Government and business to aid small extruders;

(4) Study of the current effects of the ODM,GSA, Commerce Department of Office of Export Supply policies toward aiding or injuring small aluminum fabricators; and (5) Various steps available for immediate relief for non-integrated fabricators.

Witnesses called by the Subcommittee included half a dozen aluminum extruders, who claimed they had been seriously injured in business because of non-availablity of metal from the primary producers. Donald L. O'Toole, director of commerce and industry for New York State, and Leonard Emmerglick, former special assistant to the Attorney General, and now law professor at Georgetown University, added their testimony.

Emmerglick, referring to the aluminum industry as the "most concentrated" of all major industries, felt Alcoa was still in the commanding position today that is was five years ago, when the Attorney General began a study of its alleged monopolistic position, and he would like to see the Department of Justice extend for five more years its study period over the aluminum corporation, nation's biggest.

Dewey Anderson, Public Affairs Institute, claimed that the March 23, 1954, aluminum stockpile diversion was "Government aluminum"; therefore Government had the right to consign it to whomever it wished. This, he said, put the situation squarely in the lap of the GSA, who administers contracts. Anderson estimated that possibly one-fourth of current aluminum production was going into the Government stockpile.

Senator Murray (D-Mont.) has been claiming that the original intent of the Government—although not in writing—was to give one-third of the second round of aluminum expansion to primary producer-consumers, one-third to the stockpile and one-third to non-integrated consumers. When the thirds of the stockpile and non-integrated consumers were lumped together, he argued that anything the stockpile did not use was therefore for non-integrated consumers, and that either the ODM or GSA should administer the diversions and contracts.

GSA and ODM have had no complaints about their handling of diversions, although BDSA and Senator Murray's office have had several complaints. GSA claims that when the non-integrated consumers were given their chance at extra aluminum, they were unable to use it. Nathanael Davis, president of Aluminum (Canada) Ltd., testified before the Subcommittee to the same effect.

Senator John Sparkman (D-Ala.) has been in correspondence with Dr. Arthur Flemming of ODM on the same general points brought out by the House Small Business Committee. Sparkman is on the Senate Small Business Committee.

More discussion is imminent on the issue. ODM director Flemming is considering a third round of expansion, and awaits a staff study report on its feasability.

Major Stockpile Investigation Likely; 39 Objectives Met

AT THE PRESENT, chances for a major stockpile investigation by the Senate Mining Subcommittee still looks strongly possible. Senator Murray wants to develop two questions: (1) Are the present long-range stockpile formulas being used? and (2) Are we stockpiling materials in their most expeditious forms?

Much discussion in the past has been held on the stockpile situation, along with many current investigations of the various segments of it—aluminum, lead and zinc, manganese—but this will be the first over-all investigation of the program in better than a year. It will probably develop after Congress adjourns this summer.

Stockpile Report

Although nearly five months late, the stockpile report to Congress, issued by ODM for the period of June 30 to Dec. 31, 1954, still indicates substantial progress toward fulfilling objectives. A new feature, first appearing in the last report, is a table of predicted stockpile completion levels for June 30, 1956, a year ahead.

As of Dec. 31, 1954, 39 of the 75 stockpiled materials for the minimum objectives were completed; 6 were 90-99% complete; 3 were 75-89% complete; 10, 50-74% complete; 9, 25-49% complete; and eight, 0-24% complete

Predicted June 30, 1956, levels are: 45 materials 100% complete; 9, 90-99% complete; 8, 75-89% complete; 4, 50-74% complete; 4, 25-49% complete; and 3, 0-24% complete.

Currently, $600-million in materials are on order for the total stockpile objectives of $9.6-billion. On hand are $4.9-billion, with $4.1-billion yet to be ordered.

Stockpile Purchases

Lead and zinc purchases will continue unfettered, although the question of extending them past the fiscal 1955 deadline is still undecided. Goals are not yet complete—200,000 tons of lead and 300,000 tons of zinc—and the probability is that buying will continue past the end of the fiscal year until the goals are met.

Purchases of columbium and tantalum have been completed by GSA, with the announcement that the minimum stockpile goals have been met. With no change in the current picture, ODM director Flemming estimates that all but a very few materials will have their present stockpile quotas filled within the next three years.

Congress enacted the Strategic and Critical Materials Stockpiling Act July 23, 1946.

ICC Announces Dates For Freight Rate Hearings

ON MAY 11, the Interstate Commerce Commission announced the procedure to be followed in consideration of the petition by the coal industry and others, including metal mining, for cancellation of the freight rate increases ordered in Ex Parte 175 dated April 11, 1952, as amended July 29, 1953, and the petition of the railroads asking that these increases be made permanent.

Adopted procedure requires (1) the railroads to file their written testimony, in the form of affidavits or verified statements, on or before June 6; (2) all other parties to file written testimony on or before July 5; and (3) rebuttal testimony of the railroads to be filed before Aug. 1. An oral hearing for the purpose of cross-examination of witnesses will be held in Washington, D. C. Sept. 26, provided that request has been made for such cross-examination.

"Sell U.S.–Owned Scrap Plants" –Hoover Group

HOOVER COMMISSION Report on Business Services with the Defense Department hit directly into the metal industry. Issued May 16, the report continued the trend toward getting Government out of private fields of business. Sent to Congress, the recommendations included possible sale of 39 scrap metal processing plants—27 in use and 12 maintained by the Government. Of the 27 active plants, 20 have been leased for military production and 7 are operated by contractors. Five of the inactive plants are Government-maintained, and 7 are contractor-maintained. These plants, which cost some $400-million to build, include nine aluminum sweating plants and 27 baling plants, which, however, account for only 5 to 10% of ferrous scrap supplies.

Multiple Use Outlook Good

SIMULTANEOUS HEARINGS on both the Senate and House sides of Congress were held to determine the value of the multiple surface use of public lands also used for mining purposes. House bills—5561, 5563, 5572, 5577 and 5595 (*E&MJ*, May 1955, p 102) are identical to Senate 1713, co-sponsored by Senators Anderson, Barrett, Bennett, Watkins and Aiken.

Several amendments, mostly for clarification, have been proposed, without changing the essence of the bill. Agriculture and Interior Department favored the bill, and no opposition witnesses appeared at the hearings. Outlook is still favorable.

Labor This Month

UNIONS ATTACK DEFENSE WORKER CHECK: AFL and CIO are jointly fighting a bill in Congress that would bar suspect workers from defense facilities. The idea behind the measure is to strengthen security in the nation's production plants, to have new safeguards ready in the event of an emergency. But labor leaders protested that the bill would not allow constitutional protection against unfair criticism, that the accused could not challenge the accuser face-to-face.

- Defense Department has complained that current laws are inadequate to prevent sabotage. The laws now permit an employer to fire a worker named as a security risk by the Department—provided he is doing defense work. No action can be taken against a suspect who is on a non-defense job in a vital industry.
- Strategy behind the proposals in Congress is to force removal of all suspects in all areas that could help the defense effort. There's concern over members of left-wing unions, such as Mine Mill & Smelter Workers, working in industries that become vital in an emergency. But the right-wing anti-Communist unions complain that the proposals would do more harm than good. They concede the need for safeguards but propose instead that a new Federal commission review the whole issue of security with a careful study on the best ways of preventing sabotage.

MINE-MILL WANTS PEACE BUT IS FORCED TO FIGHT: MMSW leaders are on a spot. On the one hand, they are attempting too woo rival AFL and CIO leaders into accepting the mine union in the new joint federation when it sets up shop in December. But, at the same time, they must resist representation assaults by these same unions. Score so far is a standoff.

- Attempts to move into the new federation are getting the cold shoulder. Neither AFL president George Meany or CIO leader Walter Reuther want Mine-Mill, expelled from the CIO five years ago on Communist charges, back in the fold. But MMSW got even in a recent battle with the CIO Steelworkers Union over bargaining rights at the Coronado Copper and Zinc Co. mine at Dragoon, Ariz. The steel union tried to win representation rights but lost in a National Labor Relations Board election. The vote was 74 to 50 in favor of Mine-Mill.
- However, mine union officers see the handwriting on the wall. Raiding by rival labor groups will continue and the pace will step up when the AFL and CIO combine. The betting is that Mine-Mill will continue to lose ground, following a trend of recent years.

NEGOTIATING FIGHT LOOMS IN MINING INDUSTRY: Mine-Mill leaders are planning strategy for one of their biggest contract drives in years. Currently, all eyes are on Detroit and the auto industry. If Reuther's United Auto Workers win a good settlement and a foot in the door on the guaranteed annual wage, it will mean a big boost for the mine union. MMSW has its own version of a GAW—a guaranteed $60 weekly pay for members at work or laid off.

- Reuther's success will mean a big effort for this contract provision. If he loses, Mine-Mill will soft-pedal the demand and concentrate on higher wages, In the latter case, a settlement in the steel industry will be important to Mine-Mill. CIO Steelworkers are limited to pay demands and it looks like the industry will grant more than the 8.5c raise last year. The reason: Business is booming compared with 1954, and Mine-Mill plans to take advantage of the economic upsurge.

MINE-MILL'S INTERNATIONAL SPLIT: The decision to grant the Canadian division of MMSW complete autonomy reveals more than union officers are willing to concede. It was forced by pressure of Canadian leaders who probably would have withdrawn from Mine-Mill if approval had been withheld. The move weakens the U. S. division and the fact that U. S. officers acquiesced shows that their organization is gradually declining.

- Publicly, the mine union is taking credit for being the first union to recognize an independent move on the part of Canadian unions. But, in reality, it's a clear sign of Mine-Mill's diminishing strength.

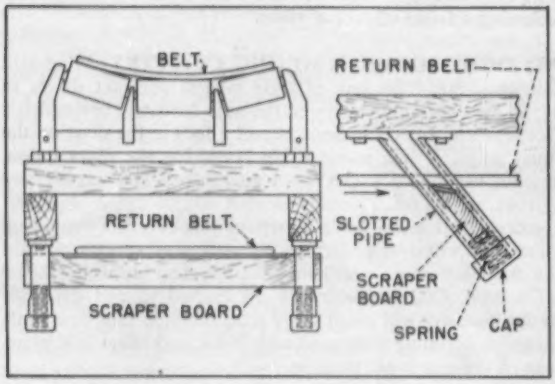
OPERATING IDEAS

EFFICIENT STOPING is aided by fork lift truck which supports two-ton drilling jumbo assembly at Swedish lead mine.

DISMOUNTABLE PLATFORM replaces jumbo and gives access to high back for scaling loose, setting roof bolts, etc.

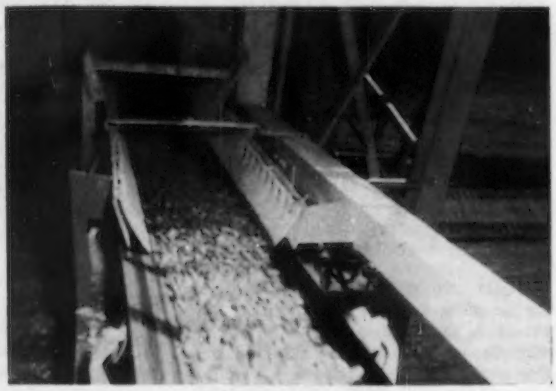
High Breast Mining Is Made Easier With Fork Lift

BENCHES UP TO 30-FT HIGH ARE DRILLED with a jumbo mounted on a Hyster fork-lift truck. The 2-ton outfit can be dismounted in 30 minutes if the truck is needed for normal service at the flat-lying Laisvall lead mines of Boliden Mining Co. in Sweden. Highly mobile, the truck can readily raise and lower the assembly to allow accurate spotting of the drilling pattern. The idea was worked out by Laisvall engineers and Hyster Co.'s Stockholm agent, Nilsons Maskin Ab. To gain access to the roof and rib, an extension platform was devised for similar mounting. Made of pipe, this attachment permits even more versatile service for the truck by making it useful in scaling loose, setting roof bolts, hanging air ducts and many other miscellaneous jobs. The truck used in this case is a 7-ton Hyster 150. The drilling jumbo is mounted directly on the slide-hoist. Forks are removed.



For Cleaning Conveyor Belts

SIMPLE SCRAPER BOARD arrangement shown above, was made from scrap and installed under the return belt near the discharge end. Successfully used at a gold-silver mine in central Mexico, it solved the problem of fines, in a soft clayey ore, sticking to the conveyor belt and dropping along the runways. The belt cleans itself by dragging over a ¾ by 4-in. board, sheet-steel lipped, that is supported by springs in a slotted pipe.



Makes Dependable Skirtboard

A MOLDED-RUBBER SKIRTBOARD cut out wear which the customary use of old belting produced. Smoother, not having exposed fabric to collect grit, it is installed very close to belt since it readily "gives" on contact. The installation has been in continuous service for six years at Pacific Coast Aggregates plant, Pleasanton, Calif., with no evidence of a "wear line" on the belt. It was molded by American Rubber Co.

United States Rubber Company 4-year project pays off—
mine operators report they're well ahead with U. S. Royal!

"Practically eliminated our downtime"
says P. Correale, Correale Construction, Hazleton, Pa.
"There's no tougher test for tires than anthracite coal stripping. Tire failure here can knock out a truck for a 7-hour shift—*for a $400 loss.* But U. S. Royal Con-Trak-Tors have practically *eliminated* our downtime."

Down Goes Downtime!

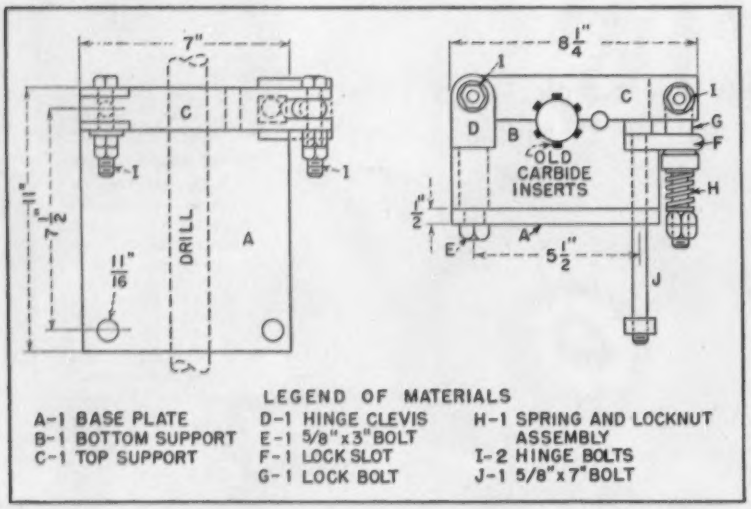
The new U. S. Royal Con-Trak-Tor—Full Lug, an important result of U. S. Royal's 4-Year Truck Tire Project, is cutting equipment downtime 'way down for leading mine operators like Correale Construction Co.

Good reasons, too! The Con-Trak-Tor's *Nylon cord carcass* stands up to vicious shocks, shrugs off rocks and snags. It has *triple impact protection*—extra rubber between plies, double shock-pads under the tread, extra-tough construction at the crown. Its *full lug traction* pulls right through toughest going, just *won't* bog down!

Why not let the Con-Trak-Tor prove it can reduce *your* downtime, lower *your* operating costs? Your U. S. Royal Dealer has this great tire in your size. Have him put it on your wheels—and prove to yourself why mine operators like Correale Construction Co. report they're *well ahead* with U. S. Royal!

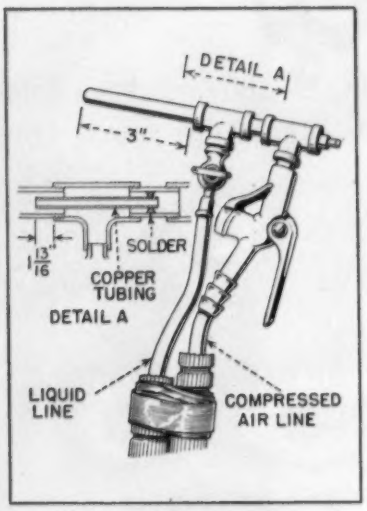
U.S. ROYAL NYLON CON-TRAK-TOR FULL LUG

ASK YOUR U. S. ROYAL DISTRIBUTOR TO SHOW YOU THE NEW FILM ON BETTER HIGHWAYS: "MEMO TO MARS"



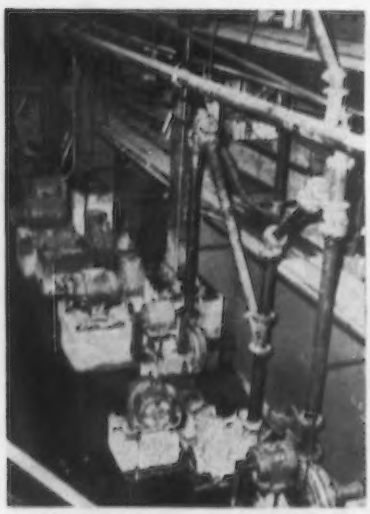
Longwearing Centralizer Uses Old TC

HOMEMADE, THE DRILL STEEL CENTRALIZER shown above can be easily and quickly put on or taken off the front end of the guide shell holding a drifter. To lock in the drill rod in a matter of seconds, just lower hinged top C and press in bolt assembly GH. Chiefly because brazed-in old tungsten-carbide inserts support the drill rod the unit lasts over a year. Conventional units wore out in 6 weeks. Designed by S. E. Rogish at Pend Oreille Mines & Metals Co., it is made from scrap at a cost of about $40 and has given excellent service in regular stope and long-hole drilling.



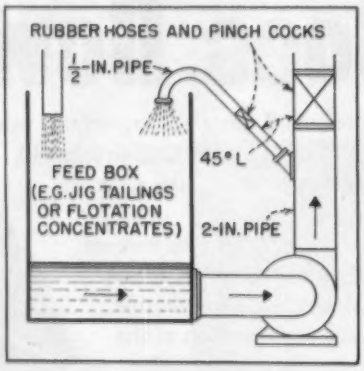
Low Cost Spray Gun

USING STANDARD ⅛-IN. PIPE and fittings, a ⅛-in. petcock, a ½-in. Lunkenheimer air valve, ¼-in. O.D. copper tubing and some hose, a maintenance man at Geneva Steel plant, Provo, Utah, made this spray gun for $5—from Westinghouse "Maintenance News."



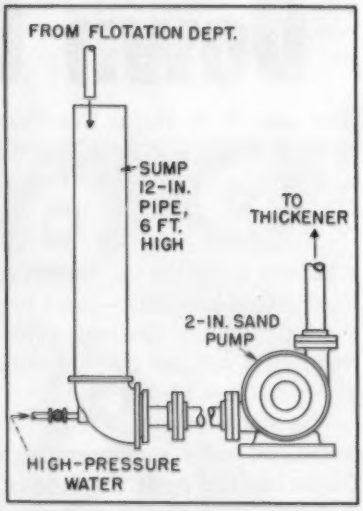
Clever Pump Piping

ONLY ONE PUMP IS NEEDED AS STANDBY for two sand pumps at Sheritt-Gordon mill, Lynn Lake, Manitoba. Piping is the key as shown above. Location of pumps for easy access is worth citing too. The pumps handle copper-nickel flotation concentrates. Valves are on both lower legs of upper Y's.



To Stop Surging

SAND PUMPS HANDLING FEED at a rate below pump capacity, are often troubled by surging. The pump rapidly empties its feed box, sucks air, then refuses to pump anything for a time. Wing L. Lew, superintendent at the Aguilar mine, Argentina, reports that the arrangement shown in the sketch above provided smooth operation on pumps handling jig tailing and rougher flotation concentrate. The pinch cocks allow the necessary adjustment of flow so that a portion of it is recirculated to give constant load.

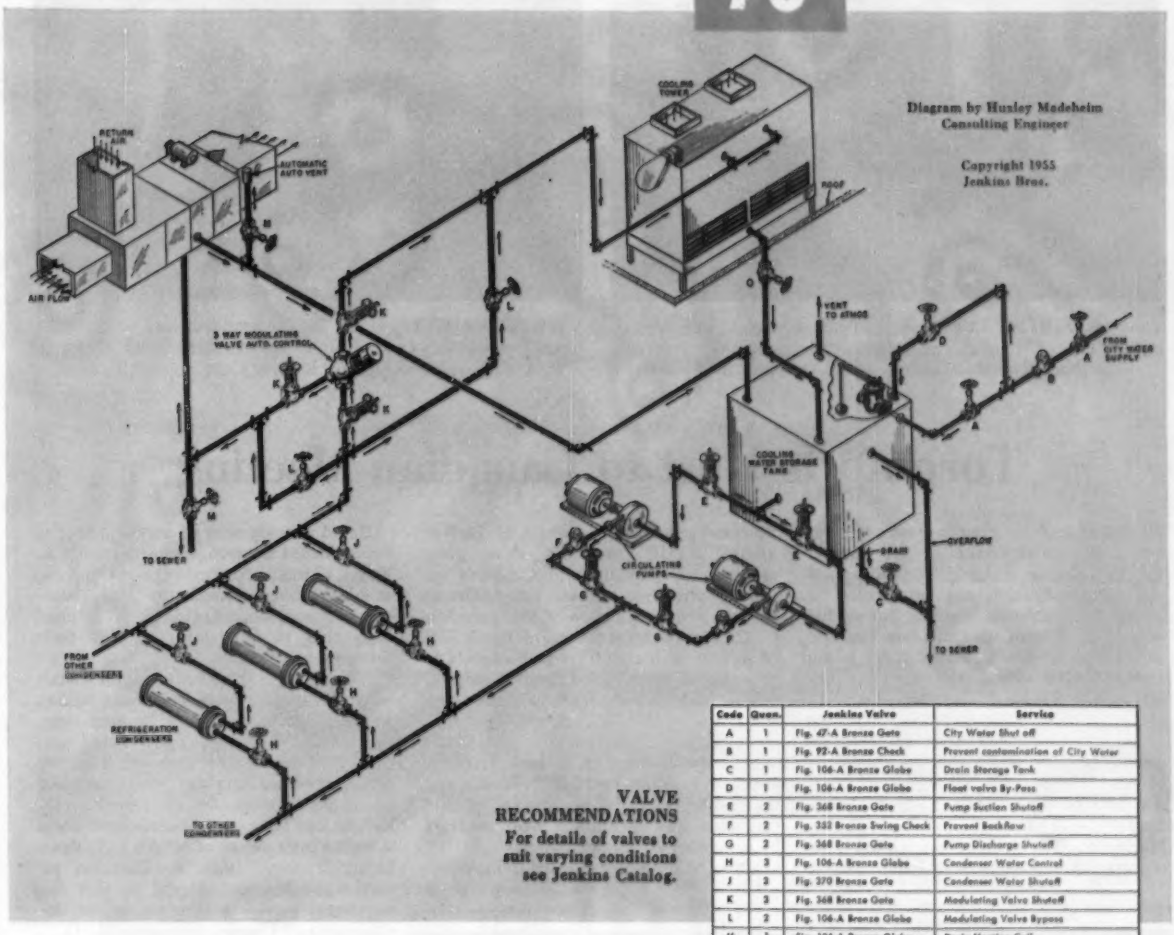


Solves Problem

WITH THE PIPE-SUMP ARRANGEMENT shown above, if the pump has a tendency to shirk the load, the sump immediately fills, increasing the suction head and causing the pump to resume pumping. The small volume also reduces the tendency of the pump to surge, by shortening the surge cycle.

JENKINS PRACTICAL PIPING LAYOUTS

75



Code	Quan.	Jenkins Valve	Service
A	1	Fig. 47-A Bronze Gate	City Water Shut off
B	1	Fig. 92-A Bronze Check	Prevent contamination of City Water
C	1	Fig. 106-A Bronze Globe	Drain Storage Tank
D	1	Fig. 106-A Bronze Globe	Float valve By-Pass
E	2	Fig. 368 Bronze Gate	Pump Suction Shutoff
F	2	Fig. 322 Bronze Swing Check	Prevent BackFlow
G	2	Fig. 368 Bronze Gate	Pump Discharge Shutoff
H	3	Fig. 106-A Bronze Globe	Condenser Water Control
J	3	Fig. 370 Bronze Gate	Condenser Water Shutoff
K	3	Fig. 368 Bronze Gate	Modulating Valve Shutoff
L	2	Fig. 106-A Bronze Globe	Modulating Valve Bypass
M	1	Fig. 106-A Bronze Globe	Drain Heating Coil
N	1	Fig. 106-A Bronze Globe	Vent Control
O	1	Fig. 106-A Bronze Globe	Cooling Tower Water Discharge Shutoff

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions see Jenkins Catalog.

How to plan piping connections for
SPACE HEATING WITH HOT WATER DISCHARGE FROM REFRIGERATION CONDENSERS

Where continuous refrigeration is required, the heat absorbed by the water circulating through the condensers during the refrigeration cycle may be transferred to circulating air and used for space heating. This hookup illustrates a system that is widely approved for utilizing waste heat in frozen food plants, ice cream plants, supermarkets, and refrigerated warehouses.

A cooling tower for water conservation is included in the usual water cooling system for refrigeration condensers, as indicated. All or a portion of the water which usually flows through the cooling tower system may be diverted and circulated instead through a water coil in the summer air conditioning unit. A three way modulating valve, actuated by a room thermostat, controls the water passing through the two parallel circuits, dividing it according to the heating requirements.

Excess heat, when all the heat is not required, is removed by regulating the amount of the water circulated through the parallel path of the cooling tower. Additional heat may be provided, when needed, from any other customary source.

The cooling tower circuit provides for water storage in a tank inside the building to avoid freeze-ups. The water circuits shown can be full weight red brass pipe, copper tubing, or black iron pipe.

This combination of refrigeration and heating is an adaption of the heat pump cycle and will provide both refrigeration and heat for minimum operating costs.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Ask for Piping Layout No. 75.

JENKINS VALVES

SOLD THROUGH PLUMBING · HEATING AND INDUSTRIAL DISTRIBUTORS

CIM PRESIDENT-ELECT A. L. Penhale (second from right), enjoys one of many social interludes in company of several other mining notables during annual meeting in Toronto.

WRY COMMENTS from Inco's president H. S. Wingate (right) preceded award of his company's Metallurgy Medal to F. A. Forward, developer of Sherritt Gordon leach process.

Toronto Is Host to Canadian Meeting

URANIUM and its atomic power aspects were the undercurrent at yet another mining meeting, judging from the guest speakers and from the attendance at uranium exploration sessions during the annual meeting of the Canadian Institute of Mining and Metallurgy. Attracting a record 1700 men and many wives, the affair was held in Toronto, April 17 to 21.

Theme of the opening and closing general sessions was "A Great Canadian Enterprise" covering all phases in Sherritt Gordon's exploitation of a nickel-copper-cobalt deposit at Lynn Lake, Manitoba. The proceedings started with registration and business meetings, then a welcoming luncheon at which H. DeWitt Smith, AIME president, was guest speaker. His mention of Canada's unusually attractive climate for American mining investment gave CIM president C. C. Huston opportunity to thank him on behalf of a country which expects to be considered "the most favored nation."

The many simultaneous technical sessions which followed during the next two days were interspersed with obviously well enjoyed social gatherings. Attendance was overflowing at major events, and the number of ladies present at the joint functions was mentioned with pleasure by a number of the registrants.

Some of the other highlights included:

"CANADIAN MINING'S VICTORIA CROSS," the Institute's medal for bravery, goes to timberman John Luca, permanently injured trying to save helper from roof fall. On left are H. DeWitt Smith, president, AIME, and C. C. Huston, president, CIM.

Rapid development of atomic power is being pushed by need, according to D. A. Keyes, Atomic Energy of Canada Ltd., at mining division luncheon. Demonstration of insignificant volume of refined U_{235} that is equivalent to other fuels fascinated the audience.

Oxygen flash smelting, a major metallurgical advance by International Nickel, was detailed to the public for first time. (See *E&MJ*, May 1955, p. 73.)

At the main dinner, a no-compensable-accident record for one year rewarded three metal mines—Waite Amulet, McKenzie Red Lake, and Cochenour Willans—with a joint award of MSA's J. T. Ryan Safety Trophy. Jules R. Timmins received the Blaylock Medal for his distinguished service to Canada in the development of Ungava iron deposits. D. J. Shaw was honored for his student essay on asbestos. R. L. Hearn, Hydro-Electric Power Commission of Ontario, declared all of Ontario's water will be harnessed by 1962, from then on the atom is their power resource.

Blind River uranium deposits are large, according to papers on that area's geology.

Cryderman shaft mucker, an air actuated clamshell on an arm, was described at shaft mucking symposium. Improvements on cable-operated equipment were cited. Also noted was a comment that South African sinking records would be strongly challenged were safety measures equal.

Canada's increasing contribution to world's iron ore supply was cited by officials of Algoma Steel Corp.

Line spacing formula for geophysical surveys was presented in paper by Canadian Aero Service staff members.

Moving of huge dredges overland was described in Steep Rock's report on dredging operations.

Monstrous job of removing 20-million tons of limestone capping at Bethlehem Steel's Mamora project was outlined.

National Zinc selects a FluoSolids* System

Two Dorrco FluoSolids Reactors were installed early in 1954 at the Bartlesville, Oklahoma, plant of National Zinc Company. Placed on the foundations of two roasters which they replaced, the Reactors deliver an 11% SO_2 gas to a contact acid plant and a calcine of controlled sulfur content for sintering prior to retort zinc production. In addition to its metal production, National Zinc is an important supplier of sulfuric acid to the Southwest area, producing 72,000 tons of H_2SO_4 yearly.

Positive advantages of the FluoSolids System at Bartlesville are:

Roasting capacity increased 25% using same plant space . . . acid plant requirements now met without use of supplementary sulfur burner.

Improved sintering product due to closely controlled sulfur content in calcine.

Variety of flotation concentrates for custom smelter are handled without complicated adjustments to changing feed conditions.

No need for extensive grinding or drying . . . System handles feed in slurry form . . . no further grinding of flotation concentrate is required.

No extraneous fuel needed as burning is self supporting once ignition temperature is reached.

High strength SO_2 produced from feed containing 31% sulfur . . . average gas analyzes 11% at the stack.

If you'd like more information on Fluidization . . . the most significant advance in roasting techniques in the last 30 years . . . just drop a line to Dorr-Oliver Inc., Stamford, Connecticut or in Canada, 26 St. Clair Avenue East, Toronto 5.

FluoSolids is a trade-mark of Dorr-Oliver Inc. Reg. U.S. Pat. Off.

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PERSONALS

AIME Legion of Honor Initiates Welcomed

Newest members of the AIME Legion of Honor received their 50-year pins at the April meeting of the New York Section. H. DeWitt Smith, Newmont Mining Co. and AIME president, presented the awards to Albert M. Austin, patent attorney (left), and Cornelius F. Kelley (right), chairman of Anaconda Copper Mining Co. In center picture, C. Y. Wang, director of research, Wah Chang Corp., receives his pin and scroll from K. C. Li, president of Wah Chang.

R. A. Pallanch, consulting mill metallurgist since 1952, U. S. Smelting Refining and Mining Co., retired Dec. 31 after a long service record with the company.

Robert E. Hayes, shift boss at Wah Chang Mining Corp., Tempiute, Nev., has been transferred to the engineering department, doing sampling and geological work for the Lincoln mine.

Ernest K. Lehmann, connected with the Third Army in Engineer Section Headquarters, Ft. McPherson, Ga., has returned to Bear Creek Mining Co., Minneapolis, and will be engaged in exploration work.

William R. Daley and **A. Dean Perry** have been elected directors of Cleveland Cliffs Iron Company. Mr. Daley replaces **W. R. Burwell,** a 26-yr board member. Mr. Perry replaces **Edward B. Greene,** retired.

John R. Ellis of Casper, Wyoming, has resigned from the firm of Jenkins & Hand, consulting geologists, to establish a consulting service for uranium, gas and oil.

Professor Eugene Pfleider, head of the department of mineral engineering, University of Minnesota, will visit mining schools and principal mining districts in Sweden, Germany, France and England. Upon his return, he will spend the balance of the summer consulting for Freeport Sulphur Co. on the Moa Bay project in Cuba.

Howard Barkell has been elected a director, and **Charles H. Winship Jr.,** a vice president of Phelps Dodge Refining Corp. Mr. Barkell is a vice president of the Refining Corp., and Mr. Winship is sales manager of both Phelps Dodge Corp. and Phelps Dodge Refining Corp.

Everett Graff, consulting geologist and representative in Peru of World Mining Consultants, Inc., recently returned to Lima from Bolivia where he examined some nickel properties between Oruro and Cochabamba for a Chicago, Ill. group.

Ralph D. Parker, general manager of Canadian operations, has been elected vice president, and **Walter A. McCadden,** assistant comptroller, has been named comptroller of International Nickel Co. of Canada, Ltd. Mr. Parker is president of Canadian Nickel Co., Ltd., the exploration and prospecting subsidiary of Inco. Mr. McCadden succeeds **Cameron R. Whitehorne,** retired.

Wayne Wright has been re-elected president of the Gunnison Area Mining Association. **John Elmer** is first vice president; **Charles Vashus,** second vice president; **John Allen,** secretary, and **Ted G. McCorkhill,** treasurer. Directors are **E. R. Williams, Boyd Roberts, Chuck Hickson, Jim Dunn** and **David Storey.**

Joseph E. Weston, manager, property examination and acquisition division, Climax Uranium Co., Grand Junction, Colo., has resigned to go into business for himself. He is succeeded by **A. M. Mastrovich** who joined the company in 1952 after association with American Smelting and Refining Co. **L. J. Brewer** succeeds Mastrovich as manager of Climax exploration department.

S. F. Mulock, president, U. S. Smelting, Refining & Mining Co., has been elected president of the American Zinc Institute. **C. Merrill Chapin Jr.,** St. Joseph Lead Co.; **R. G. Kenly,** New Jersey Zinc Sales Co. and **E. H. Snyder,** Combined Metals Reduction Co., were elected vice presidents. **Erle V. Daveler,** American Zinc, Lead & Smelting Co., was re-elected treasurer and **John L. Kimberley** was named secretary. Ernest V. Gent continues as executive vice president. The following directors were elected for the term ending 1958: **H. D. Carus,** Matthiessen & Hegeler Zinc Co.; Mr. Chapin; **M. L. Havey,** New Jersey Zinc Co.; Mr. Kenly; **S. H. Levison,** American Smelting & Refining Co.; Mr. Mulock; **R. F. Orr,** Athletic Mining & Smelting Co.; **O. A. Rockwell,** Eagle-Picher Co.; **C. H. Winship Jr.,** Phelps-Dodge Corp.; and **H. L. Young,** American Zinc Sales Co.

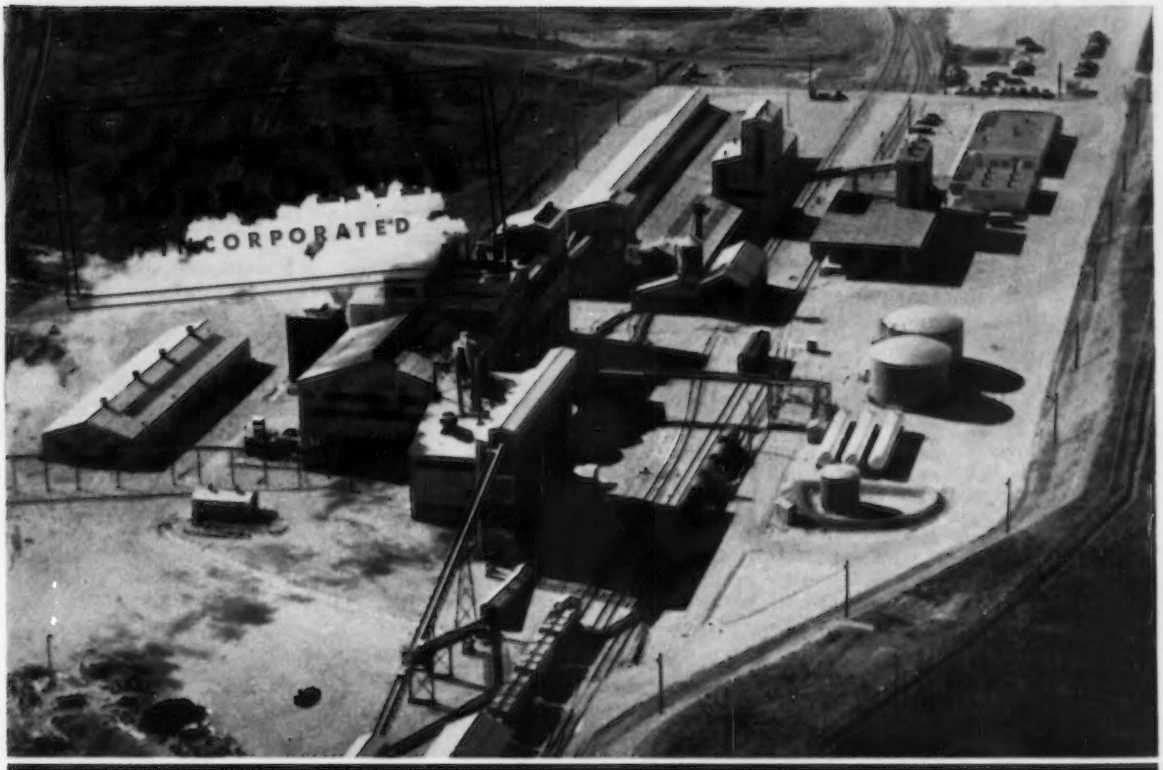
Dr. Robert H. Flinn has been appointed chief of the division of health, U. S. Bureau of Mines. The division, established in December, is part of the reorganization of the Bureau's health and safety activities. Dr. Flinn has been with the Public Health Service since 1931.

F. W. Denton Jr., superintendent of Gogebic range operations, Oliver Iron Mining division, has resigned to accept a position as general superintendent, Philippine Iron Mines Inc., Luzon, P. I.

Kenneth M. Dewar, superintendent, Errington iron mine, Steep Rock Iron Mines, Ltd., has resigned to join the mine plant construction firm of R. M. Way & Co., Toronto, Canada.

Eugene D. Gardner has retired as chief mining engineer of the U. S. Bureau of Mines after nearly 44 years of Government service. Mr. Gardner holds the Jackling Award of the AIME and the Distinguished Service Award and Gold Medal of the U. S. Department of the Interior.

Denton A. Schriver, assistant secretary, has been named secretary of Vanadium Corp. of America. Mr. Schriver joined the company in March 1953.



New MFA Concentrated* Fertilizer Plant Now On Stream...

***Based on diammonium phosphate**

Missouri Farmers Association, one of the nation's largest farm cooperatives, is now producing 200 tons per day of high analysis fertilizers at this new plant near Joplin, Mo. First to produce complete granular fertilizers for its members, MFA selected Dorr-Oliver as architects-engineers for this new project. And D-O engineers delivered by bringing the plant into full production just a little over three months after the first raw materials left the feeder bins!

Using the Dorrco Continuous Granular Fertilizer Process, the plant produces a variety of complete mixtures, all based on diammonium phosphate. Included are 14-14-14, 14-28-14 . . . and 12-36-12, the highest analysis complete fertilizer ever produced for general farm use.

If you are considering entering the fast-growing chemical fertilizer field — or if you plan to expand present facilities — it will pay to check with Dorr-Oliver.

Free-flowing granules . . . important characteristic of high analysis chemical fertilizers produced by Dorr-Oliver designed plants.

Write for Bulletin #8000, or better still, let us send an engineer to discuss your problem from the standpoint of economics and process. No obligation, of course.

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STAMFORD • CONNECTICUT • U.S.A.

PERSONALS (*continued from p* 112)

Byron E. Grant, mining consultant of Salt Lake City, has been named assistant general manager of Braden Copper Co., Sewell and Rancagua, Chile. Mr. Grant, a graduate in mining and geology, University of Utah, resigned November 1954, as assistant to the vice president and general manager of operations, United States Smelting Refining & Mining Co.

John H. Simpson has been named deputy mine inspector, northern Nevada district, replacing **Paul Piscevich,** resigned. Mr. Simpson has been engaged in mining in Nevada during the last 10 yr, his last position being foreman, Lincoln mine, Black Rock Mining Corp.

Peter Mahon of Prince Albert, has been elected president of the Saskatchewan Chamber of Mines, Canada.

Merle H. Guise, consulting mining engineer, is now temporarily located c/o American Express Co., GPO Box 7006, Sydney, Australia. He has been exploring Australia for possible development of uranium and other metals.

John Sherwin has been named senior managing partner of Pickands Mather & Co. **H. C. Jackson** and **A. D. Chisholm** have been named managing partners. Mr. Sherwin was elected president of the Interlake Steamship Co., a PM operation, succeeding the late Elton Hoyt 2d. Other Pickands Mather officials moved up at Interlake include Mr. Jackson and **George Callahan** as vice presidents, **E. C. Brunner,** treasurer and **J. E. Harkness,** secretary.

Directors of American Smelting and Refining Co. have elected **R. Worth Vaughan** executive vice president and **Oscar S. Straus** vice president and treasurer. Mr. Vaughan joined the company in 1937 as assistant general counsel and became vice president and general counsel in 1947 and a director in 1948. He will continue as general counsel. Mr. Straus joined the company in 1946 as assistant to the treasurer, became treasurer in 1949 and was elected a director in 1951.

At a recent meeting of Indian Mines Ltd., of Vancouver, B. C., the following were elected as directors: **G. Howard Forester, G. E. Burdick, Roderick McLennan, Earl H. Hemsworth, Harold H. Hemsworth** and **T. E. Blossom.**

F. O. Reedy, vice president and general manager for the past 20 years, has been elected president of Kennedy-Van Saun Mfg. & Engrg. Corp. succeeding **J. E. Kennedy,** who was named chairman of the board. Mr. Reedy joined the company in 1920. The announcement was made concurrently with the celebration of Mr. Kennedy's 92nd birthday

C. L. Kingsbury Jr., general foreman of concentrating and crushing, Babbitt plant, Reserve Mining Co., has been named superintendent.

Reynolds Metals Co. has elected the following vice presidents: **C. E. Coghill,** treasurer; **John Krey,** assistant to the president and **W. Monroe Wells,** assistant to the vice president of operations.

Roger M. Blough, general counsel and vice chairman since 1952, has been elected chairman of the board, United States Steel Corp., succeeding **Benjamin F. Fairless** who retired but will continue as a member of the board and of the finance committee. **John S. Tennant,** associate general counsel, succeeds Mr. Blough as general counsel.

William Rudolph, an engineer for Chile Exploration Co., has been decorated by the Chilean government for the splendid social work he has done in various small villages near the Chuquicamata camp.

W. P. Pan and **Robert R. Wallace,** Oliver Iron Mining division mining engineers, have each been appointed assistant chief mining engineer for the Hibbing-Chisholm district, in Minnesota.

John Payne Jr., with American Metal Co. since 1940, has been elected a vice president in charge of mining and exploration.

William Peltonen, ore grader for M. A. Hanna Co., Hibbing, Minn., has been transferred to Labrador where he will be in charge of the ore grading department in the new district.

Alfred G. Hurley has been promoted to safety supervisor for Cleveland Cliffs Iron Co.'s Mesabi range operations, succeeding **George Whittington,** who retired March 15, after 50 years of service.

Ralph E. Magnuson Jr., administrative assistant, Cleveland Cliffs Iron Co., has been transferred to Ishpeming, Mich., as administrative assistant to the manager of ore development.

N. J. Knickerbocker, general manager, Wm. H. Ziegler Co., Duluth and Hibbing branches, has been named a vice president and director of the company.

Kennecott Copper Corp.'s Nevada mines division has made the following changes: **William Mansfield** has been promoted from chief engineer, power plant, to assistant mechanical-electrical superintendent; **Theo L. Anderson,** from master mechanic to mechanical superintendent of the mining department; **Scott L. Burrill,** from acting mill general foreman to mill general foreman; and **Donald B. Tate,** from tool machinist to machine shop foreman.

H. A. Ziebell, superintendent, Northwest Magnesite Co., Chewelah, Washington, has been named state chairman of the program committee for the American Mining Congress meeting, October 10-13 at Las Vegas, Nevada.

Roy H. Glover, vice president and general counsel, Anaconda Copper Mining Co., was personally decorated by President Carlos Ibanez of Chile, with the Order of Merit, one of the highest honors bestowed by the Chilean government. Mr. Glover has contributed much to the economy of Chile in connection with its copper industry.

W. G. Emminger, manager, Nevada-Massachusetts Co. mine, Tungsten, Nevada, for the past 25 years, resigned to fill a vacant post of state senator from Pershing County. **Eldridge Nash,** mine superintedent, succeeds Emminger, and **Daniel O'Keefe,** mining engineer, succeeds Nash.

Ralph H. Wilpolt, associate professor of geology, New Mexico School of Mines, has been named deputy director, exploration division, AEC, Grand Junction, Colo.

Charles B. Tillson Jr., mine superintendent since 1953, has been named general superintendent of the Crucible Steel Co.'s mine at Crucible, Pa.

Nicholas S. Muccilli, superintendent, Perth Amboy metal division since 1951, has been named plant manager, National Lead Co.'s Perth Amboy plant, succeeding **Robert A. Putney,** who has been named manager of National Lead's metal department.

H. I. Altshuler, consulting mining engineer, has been made a director and vice president of New York and Honduras Rosario Mining Co. **David L. Moore,** chief geologist of that company, has been named vice president of the Rosario Exploration Co.

KENNEDY ROD MILLS

○ noted for.... low maintenance and exact specifications in manufacture of SAND

KENNEDY 4' x 10' CENTER DISCHARGE ROD MILL FOR SPECIFICATION SAND AT FRANK M. SHEESLEY CO. KUNKLETOWN, PA.

ONE OF TWO KENNEDY 5' x 12' CENTER PERIPHERAL DISCHARGE ROD MILLS AT REFRACTORY SAND CO., ANDREAS, PA.

KVS Rod Mills built to perform a specific, and important, function ...producing a grade of sand to meet rigid specification. These mills not only meet these requirements, they continue to make sand of a *uniform grade*, economically and without costly maintenance. Whether your pulverizing and grinding problems involve sand, cement, lime or coal, KVS has the equipment you need that is best suited for the job—

KVS sales-engineers are available for consultation anywhere—anytime!

See what Mr. Neal McMullen, manager of Frank M. Sheesley Co. reports on KVS Rod Mills:

"We are one of the very few Companies in our area capable of making sand to the rigid Turnpike specifications. Our KENNEDY Rod Mill is, in large measure, responsible for this ability to produce and hold gradation. We invesfigated thoroughly before buying and are now certain it pays to own the best."

Let us run a KVS Rod Mill test on your material.
WE'LL PROVE TO YOU THAT ....

IT COSTS LESS ... TO OWN THE BEST!

SEND FOR BULLETINS DESCRIBING KVS MACHINERY AND EQUIPMENT.

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TWO PARK AVENUE • NEW YORK 16, N. Y. FACTORY: DANVILLE, PA.

PERSONALS *(Continued from p 114)*

Charles M. Brinckerhoff (above), general manager of Chile Exploration Co. at Chuquicamata, Chile, since 1948, has been appointed general manager of South American Operations for Anaconda Copper Mining Co. and its subsidiaries. **Norbert F. Koepel,** general manager, Andes Copper Mining Co. since 1948, has been named assistant general manager, South American Operations.

St. Joseph Lead Co. has elected the following officers: **Robert H. Ramsey,** formerly editor of *Engineering & Mining Journal,* has been named secretary, succeeding **Robert Bennett** who retired after 49 years of service with the company; **James G. Colvin,** assistant secretary and assistant treasurer, has been elected comptroller and assistant treasurer; **William J. Elliott** was elected assistant secretary; and **Edward P. Merrell** was named assistant treasurer.

Durwood J. Hedgecock, division staff engineer, has been named chief engineer, Reynolds Metals Co.

C. Davis Blackwelder, a vice president of Reynolds Metals Co., has been appointed consulting engineer for the operations division.

James M. Todd, for 20 years a consulting engineer, Jefferson Lake Sulphur Co., has been appointed consultant to Mexican Gulf Sulphur Co.

Lamar Kelley, manager, public relations department, Allegheny Ludlum Steel Corp., Pittsburgh, for the past 10 years, has been named director of public relations, Climax Molybdenum Co.

William A. Bowes has been transferred from Marysvale, Utah to Bakersfield, Calif. as geologist for the AEC.

Matthew R. Banovetz, foreman since 1953, has been appointed superintendent of pelletizing, Babbitt plant of Reserve Mining Co. **August F. Torreano,** mine superintendent, has been named superintendent of taconite operations.

E. Herrick Low, executive vice president, Chemical Corn Exchange Bank of New York City, was elected a director of Nichols Engineering & Research Corp. on April 6.

James W. Franklin has joined the staff of *Engineering & Mining Journal* as an assistant editor. After graduating from Heidelberg College, Tiffin, Ohio, he joined Pennsylvania Salt Mfg. Co. as a chemist. In 1954 he became resident engineer for Lucius Pitkin Inc., metallurgical chemists and consultants, and was assigned to the Benjamin Franklin Graphite Plant in Pennsylvania.

Folke H. Kihlstedt, formerly with Orinoco Mining Co. in New York and Venezuela, has joined the Oliver Iron Mining Division as consulting mining engineer.

George Gedge, safety director in copper mining, Calumet & Hecla, has been named safety engineer, Copper Queen Branch, Phelps Dodge Corp., Bisbee, Ariz.

Granby Consolidated Mining, Smelting & Power Co., Ltd., has elected the following officers: **Julian B. Beaty,** president, has been named chairman of the board; **Lawrence T. Postle,** vice president and general manager, has been named president, and **J. A. Ross,** general superintendent, Copper Mountain, B. C., has been named general manager.

Donald D. Smith, chairman of the board, Central Eureka Corp., San Jose, Calif., has been elected president, but will continue as board chairman. **H. J. McPherson,** former president, resigned to become president of Interstate Chemical Co., Santa Clara, Calif. He will remain on Central Eureka's board of directors.

Thomas R. Harrison, engineer at United Park City Mines Co. for 9 years, has been named general superintendent, Lucky Mc Uranium Co.

A. Clifford Melting, former concentration plant superintendent, Lone Star Steel Co., has been named vice president, Western Mines, Inc., a subsidiary of Western Development Co. of Santa Fe.

E. A. Noble has recently become a geologist with the AEC in Grand Junction, Colo.

Frank C. Pickard, head of the mining division, Gregg Car Co., Ltd., left Brussels, Belgium recently on an extended trip through Nigeria, Gold Coast, Angola, Belgian Congo, Rhodesia, South Africa and East Africa.

Robert A. Blake has been promoted by American Smelting & Refining Co. from mill superintendent, Van Stone Mine, Colville, Washington, to mill superintendent, Lake Asbestos of Quebec, Ltd., Black Lake, Quebec, Canada, a subsidiary company.

Thomas W. Mitcham, exploration manager, Consolidated Ranwick Uranium Mines, Ltd., will head the new offices located in Denver, Colo.

Robert S. Stevenson, executive vice president of Allis-Chalmers Manufacturing Co. since July 1952, has been elected president succeeding the late **William A. Roberts.**

C. Hyde Lewis, vice president and general manager, New Idria Mining and Chemical Co., has been elected president. He joined the company in 1936.

Paul Juul, industrial engineer, Kennecott's Ray Mine division, has left for Sewell, Chile, to become chief industrial engineer, Braden Copper Co.

W. K. Scheibe, chief engineer, Reserve Mining Co., Babbitt, Minn., has been appointed assistant manager, Liberia Mining Co., Ltd., Monrovia, Liberia, West Africa, a subsidiary of Republic Steel Corp.

P. E. McGarry has recently been employed as research investigator in mineral dressing by New Jersey Zinc Co. of Pennsylvania, at Palmerton, Pa.

Earl E. W. Kearly, formerly with Northern Peru Mining & Smelting Co., Trujillo, Peru, S. A., has taken a position with Tsumeb Corp. Ltd., Tsumeb, South West Africa, as mine captain.

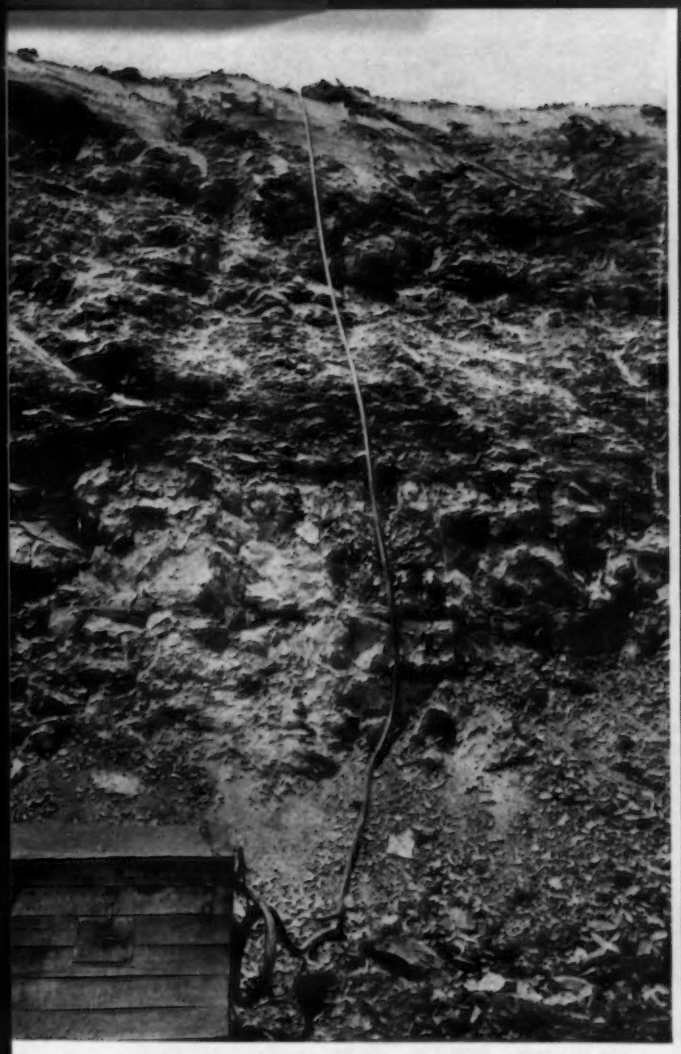
Vernon C. Robinson, formerly with St. Paul Foundry and Mfg. Co., has joined the development and research division, International Nickel Co., Inc. in Minneapolis, Minn.

Henry S. Schaufus has been named chief metallurgical engineer, Vanadium Corp. of America. His metallurgical background dates back to 1929.

W. B. G. Walker, formerly with Bear Creek Mining Co., has been named geologist, Utah Copper division, Kennecott Copper Corp.

George Luckow, chemist at Crosby Laboratory, Lerch Brothers, Inc., Hibbing, Minn., has been promoted to chemist in charge of the Nashwauk Laboratory, succeeding the late **Harry Olson.**

Jack W. Reinhart, since 1953 geologist with Great Lakes Carbon Corporation, has been promoted to manager of geology and quarry operations department, Perlite and Dicalite divisions.



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OPEN PIT OR UNDERGROUND, Anaconda butyl-insulated Mine Power Cable offers exceptional mine water- and abrasion-resistance.

FOR YOUR PROTECTION—

We proved this power cable in our mines

Being miners ourselves, we know mining problems. As both miner and cable manufacturer we're able to do something about them—by *designing* cable to meet problems only miners can know . . . by testing this cable in *our own mines* under actual field conditions.

FOR MINE POWER CABLE

Our firsthand mine experience has helped us build a sturdy cable that cuts down-time. Butyl insulation gives this cable long-aging characteristics, improved resistance to moisture, ozone and heat. Neoprene jacket—rugged, tough—has real flexibility, and resists rock-cutting, impact, flame, sun, and corrosive mine water.

Your Anaconda Distributor has full facts and can help you choose the cable best suited to meet your needs. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Trade Mark

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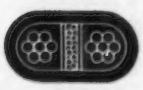
MINE CABLE

FLAT-TWIN CABLE



Improved stranding, new insulation, new grounding wire, and neoprene jacket make this a superior cable for shuttle cars, continuous miners, loaders, drill trucks, cutters.

POWER CABLES

Anaconda Types W & G are rugged, sturdy and long-lived. Used for mine power, shovels, continuous miners, loaders, drill trucks, cutters.

SHOVEL AND DRILL CABLES

Securityflex* Types W and G are used with small shovels, self-propelled drill trucks, pumps and a-c mining equipment. For higher voltages, Type SH cables (shielded) are recommended.

SECURITYFLEX CORDS

Unexcelled for strength, wear resistance and long life. Type SO cords (heavy-duty) provide superior service on remote control and hand drills.

TROLLEY WIRE

FEEDER CABLE BARE OR INSULATED

TELEPHONE WIRE

SHOT-FIRE CORD

WELDING CABLE

PERSONALS *(Continued from p 116)*

Walter C. Bennett, since 1935 president of Phelps Dodge Refining Corp., has been named chairman of the board of directors. **Carleton S. Harloff,** executive vice president, succeeds Mr. Bennett as president.

Fred W. Argue has been named vice president, Stone & Webster Engineering Corp. Joining the firm in 1941, prior to his appointment he was engineering manager.

Clarence B. Sampair, vice president in charge of production and industrial relations and president of the international division, has been elected to the board of directors, Minnesota Mining & Mfg. Co., St. Paul, Minn., succeeding the late **Richard P. Carlton.** Mr. Sampair joined the company in 1927.

The following changes in personnel in the Anaconda smelting department, Anaconda Copper Mining Co., were recently announced: **E. A. Barnard,** general superintendent, Anaconda Reduction department since 1941, has retired. He will be succeeded by **W. A. Emanuel** who was superintendent, Anaconda Zinc plant since 1938. **H. J. Maguire,** superintendent of smelting since 1941, has retired and is succeeded by **J. H. McCrea,** former assistant smelter superintendent. **J. R. Moore,** superintendent, Ferromanganese plant, has been promoted to superintendent, Ore Crushing and Conveyor plant in East Anaconda. **C. M. Holstrom,** superintendent of leaching at the Zinc plant, succeeds Mr. Emanuel. **E. S. Kramlich,** assistant superintendent, Ferromanganese plant has been promoted to superintendent of that plant.

OBITUARIES

William A. Roberts, 57, president, Allis-Chalmers Manufacturing Co. since February 1951, died April 12 following a heart attack. Mr. Roberts joined the Allis-Chalmers Tractor Div. in 1924. In 1931 he became general sales manager of the tractor division, in 1943 was named vice president in charge of the division and in 1947 was named executive vice president. In 1948 he was named a company director and member of the executive committee.

Martin H. Crego, 78, manager of sales, Phelps Dodge Corp. until his retirement in 1949, died May 7 at his home in Brooklyn, N. Y. He joined the company in 1892.

H. C. Bolthouse, 67, superintendent, Hill-Trumbull mine, Cleveland Cliffs Iron Co., Marble, Minn. until his retirement two years ago, died Feb. 13 at his home at Vero Beach, Fla.

Charles H. Claypool, 73, well known on the Mesabi Range where he was superintendent in charge of the Todd-Stambaugh Co. operations, died recently while visiting his son at Rumford, Maine.

Frank A. Hiter, 63, senior vice president, Stewart-Warner Corp. since 1944, and head of the Alemite and Instrument division, died April 9 in Chicago, Ill. Joining Alemite Corp. as assistant sales manager in 1920, 4 yr before it was purchased by Stewart-Warner, he became vice president in 1933.

Mrs. Margaret Orr, 82, secretary of Northwest Mining Association for 18 years prior to her retirement in 1947, died April 26, in Spokane, Washington.

Gordon W. Cameron, 60, vice president and treasurer, Aluminum Company of America, died April 30 in Pittsburgh, Pa., following a brief illness. He joined the company in 1916.

James Farley McClelland, 77, retired vice president and director, Phelps Dodge Corp., died May 6 following a long illness, at his home, Mead's Point, Greenwich, Conn. Mr. McClelland joined Phelps Dodge in 1931 as a vice president and director, and became a member of the executive committee in 1940. He resigned as vice president in 1947, but continued as director until 1952.

Thomas S. O'Brien, 84, retired mining engineer, died April 25 at his home in Ione, Calif. He was associated with mines in Colorado, Nevada, Arizona and Cal.

Blind River Uranium

(Continued from page 96)

Currently favored hunting ground is the syncline between the north and middle limbs, where the conglomerate may be rather deep, perhaps requiring holes down to 3,500 or 4,000 ft. Operating costs are not expected to be high; biggest adverse factor being cost of ventilation. (Canadian mines are already operating efficiently at 8,000 ft.)

Corresponding position in the south loop of the structure (the anticline) is considered unfavorable because sediments have been eroded. But copper possibilities within the greenstone remnants are being investigated. Favorable areas along the south remain to be drilled and a few companies are working the north shore of Lake Huron.

Country west of the structure is unknown. Several companies have found favorable sediments and basement rocks have been located. Work to date indicates that depth of conglomerates is shallow to the south, deeper to the north.

No major displacement has been indicated within the ore zones. Numerous minor faults have been evident, but nothing sufficient to suggest any difficulty in mining. Several narrow diabase dikes, near vertical, have been found on the Pronto property, two large similar dikes on Algom's Nordic Lake and none on Algom's Quirke. Other dikes, notably at Magoma and Stanleigh, have been cut in drilling. These dikes show an east-west strike.

Most remarkable geological feature of the camp, according to observers, has been its continuity of beds and grade of uranium (average 0.11% to 0.14)% over large distances. Many compare it with the Rand.

Record sums of money have been raised for exploration and construction and for acquisition of property. $40-million was raised by Algom Uranium, with an additional $16.5-million possible, if required. Pronto sold $6-million worth of debentures. Spanish-American was acquired for plus $1.25-million and has an equal amount in the treasury. Consolidated Denison has made arrangements for a $22-million bond issue and has $2.5-million in the kitty. Can-Met has $1.5-million.

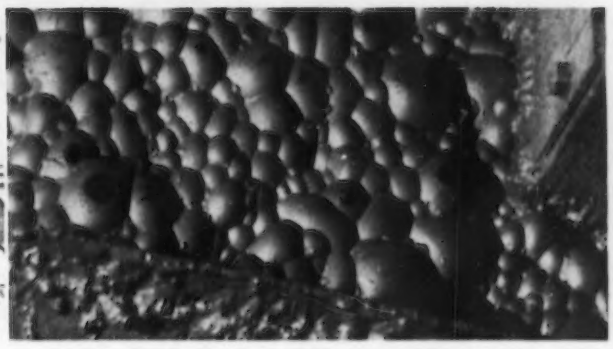
While transportation access to the area is excellent, connections to individual properties are still difficult. Algom has constructed a road from Highway 17 north 30 miles to the Quirke Lake deposit. Algom's Nordic development is about midway on the road, which will be improved by the Ontario government and be useful to other operators in the area. A second road runs west to Matinenda Lake, but aircraft still perform most of the transport.

ommended.

WELDING CABLE

DOW

FROTHER CONSUMPTION TAKES A CUT WHEN DOW FROTH 250 GOES TO WORK



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Dowfroth® 250 saves money—this is a fact now confirmed by mill men the world over. Savings are achieved in two ways. Dowfroth 250 builds livelier, easier-handling froth with as little as one quarter the consumption of frothers previously used. Dowfroth 250 also produces improved concentrate grade and metal recovery in mill after mill.

Operators report that they are better able to regulate frother and collector independently, due to Dowfroth's essentially noncollecting characteristics.

Of course, the superior collectors to use in all flotation of sulfide minerals are Dow Xanthates—tops in recovery records today as they have been for many years.

For helpful technical assistance and the best in flotation agents, always call on Dow. THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. OC-816H-1.

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DOW

 (Continued from p 73)

UOPA Hears Mill, Securities Problems

UNANIMOUSLY RE-ELECTED officers of UOPA at annual meeting are Thomas H. Skidmore (standing) president; and (seated, left to right) Kim Theobald, secretary-treasurer; Stephen L. R. McNichols, counsel; Norman Ebbley, vice president; and John Schumacher, vice president.

ANNUAL CONVENTION of Uranium Ore Producers Association, held in Grand Junction May 6-8, heard industry and Government leaders discuss uranium problems and successes, re-elected association officers, appointed new directors and selected a beauty queen.

Sheldon P. Wimpfen discussed milling on the Plateau and said present mill facilities now are processing ore at a rate more than three times that of 1952 (see p 75, this issue). Plant increases cited by Wimpfen include: 290% at Climax Uranium's Grand Junction plant; 156% at VCA's Naturita and 152% at the same firm's Durango plant; 186% at U. S. Vanadium Uravan operation and 24% at the USV Rifle; 212% increase at the Vitro plant in Salt Lake City, and 490% at the Government-owned installation at Monticello.

Keynote speaker Stephen L. R. McNichols, lieutenant-governor of Colorado and legal counsel of UOPA, urged the organization to fight to open up milling operations "if the independent operator is to survive on the Colorado Plateau."

Principal speaker was Gov. Edwin Johnson of Colorado. Other speakers included C. O. Mittendorf, director of DMEA, who discussed increased assistance to be given to uranium mining by DMEA; Miles Romney, Utah Mining Association; Vance Thornburg, Thornburg Mining Co.; Clyde Boyle, Sodak Mining Co.; Irving (Rusty) Rapaport, Four Corners Exploration Co.; Dr. Tom Nolan, acting director, USGS.

New and re-elected directors of UOPA include: Clyde Boyle, Art Ludwig, South Dakota; Neal McNeese and H. D. Hand, Wyoming; Garth Thornburg, T. R. Gillenwater, Arizona; Mr. Rapaport, Tom Bollack, Joe McCormick, Cato Sells, Victor Salazar and John Chambers, New Mexico.

Also T. H. Skidmore, M. C. McGrath, Guy Dyer, Dove Creek-Cortez, Colo.; D. Lew Williams, R. E. Williams, Dwight Oliver, Naturita-Norwood, Colo.; Belmont Richards, Gene Sanders, Jack O. Jones, Green River; Howard Balsley, J. W. Gramlich, Abe Day, Dan O'Laurie, Claude M. Hickman, Moab; Eddie Hall, Walt Bronson, Fendel Sitton, Leon Adams, Blanding-Monticello; Norman Ebbley, John Schumacher, Gordon Babbel, Blair Burwell, C. G. Ortmayer, W. E. Haldane, Harry Morgan, Grand Junction; and A. C. Rinderle, Roy Stone, Jake Lewis, Gateway.

T. R. Gillenwater, Uranium Engineering Sales Co., Grand Junction, presided at the radiation instruments panel. Speakers included Walter Bilicke, Engineers Syndicate Ltd.; Ray Neuschwanger, Uranium Engineering Co. Gillenwater, who announced formation of the National Association of Radiation Equipment Manufacturers, predicted sales of radiation detection instruments will exceed $10-million in 1955.

E. H. Sanders, Four Corners Uranium Corp., presided at a panel on stocks and securities which heard Curtis White, Colorado director of securities, criticize practices of some company promoters.

"The day of reckoning . . . is not too far distant," he warned. "Questionable practices" which he noted included excessive commission costs charged by some underwriters and reservation of blocks of stock by underwriters at a cost under that charged to the public. Other speakers included Joseph H. Krys, acting regional director, SEC, and Walter Gutman, Goodbody & Co.

Vernon Pick, Gordon Babbel and Cecil Walt, beauty contest judges, chose Miss Karen Keeler, 20, of Denver, "Miss Atomic Energy." Her gifts included an 11-ton truckload of 0.47% uranium ore, donated by Four Corners Uranium Corp., for which Miss Keeler received a check for $523.54.

Kelley Retires as Anaconda Chairman

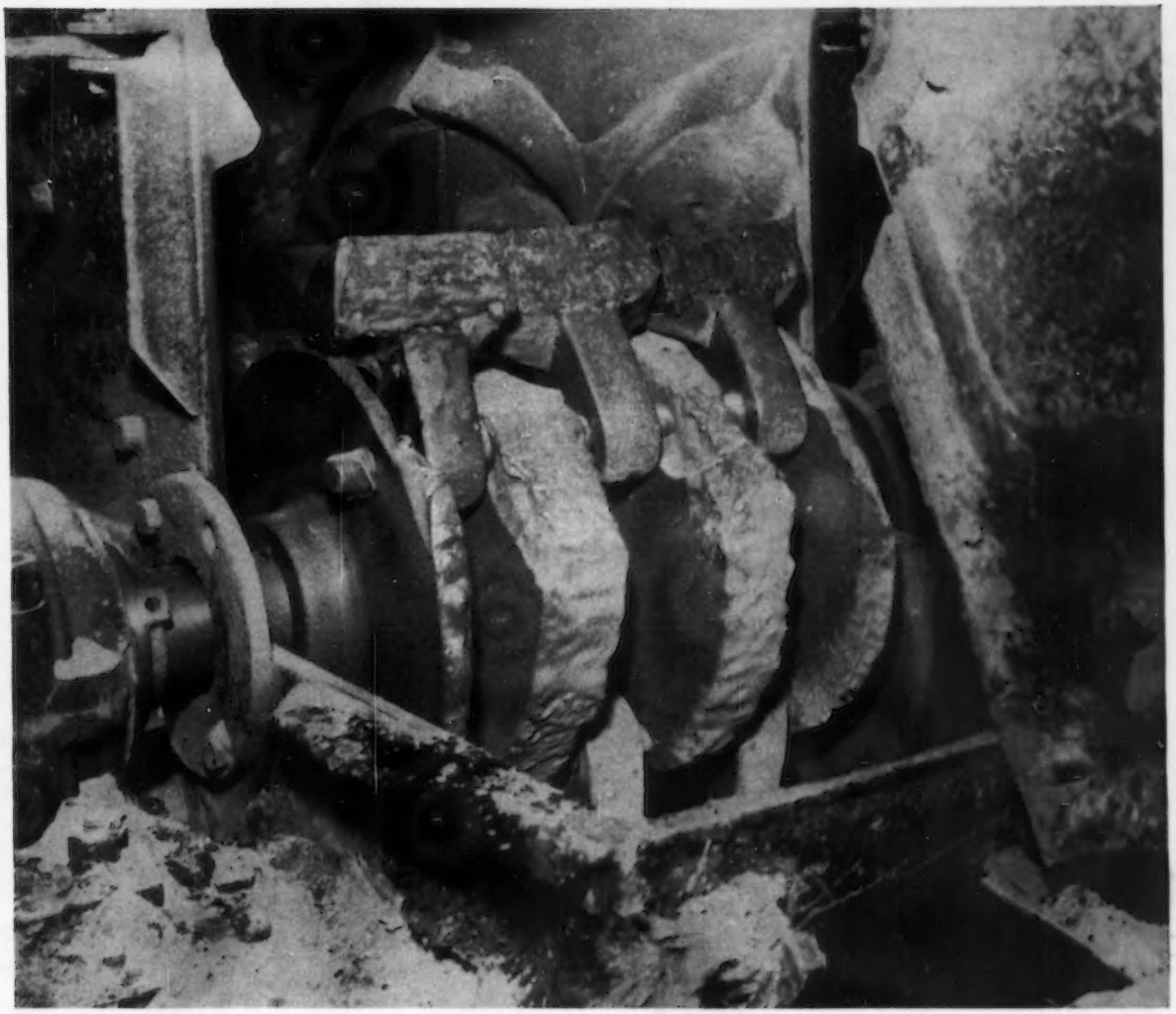
CORNELIUS F. KELLEY, dean of the copper industry, announced his retirement as chairman of the board of Anaconda Copper Mining Co. at the annual meeting May 18. He will continue as a director.

Also re-elected as directors were Robert E. Dwyer, president of Anaconda, and E. Rolland Harriman.

Stockholders approved a proposal to change the corporate name of the organization to the Anaconda Company. New name was expected to become effective June 18. Directors had recommended that the name be changed because of the widening scope of the company's operations.

Mr. Kelley, who is 80 years old, began his career with Anaconda at the age of 17 as a member of a survey crew. He resigned to study law. In 1899 he became a member of the House of Representatives of Montana. He rejoined Anaconda in 1901 as a member of its legal department, became general counsel in 1908, vice president and director in 1911, president in 1918 and chairman in 1940.

(Continued on p 198)



The periphery of the hammer mill rotor discs pictured here is regularly maintained with Coated Tube Stoodite, a high alloy electrode providing extreme wear resistance.

HOW TO GET MORE FROM YOUR HAMMER MILLS

Crushing decomposed rock and clay to produce material for wet-finished brick is a rough job and mighty tough on mill hammers. The Chattahoochee Brick Company in Chattahoochee, Georgia, has established a maintenance procedure that is producing more material at considerably lower cost by the use of Stoody alloys.

The raw material is dry-crushed in a pair of double rotor hammer mills. The problem, as usual, is to maintain the corners on hammers and keep them out to size as long as possible. The corners and edges of the hammer are, of course, subjected to severe impact and abrasion. At Chattahoochee Brick Company *new* manganese hammers are capped with an overlay of Stoody 21. As corners become rounded and the efficiency of the mill drops off, the hammers are pulled and turned over to the weldor for rebuilding.

Worn hammers as shown in the illustration are brought back to size with Stoody Manganese and the entire wearing area is hard-faced with Stoody 21. Records show that some hammers have been rebuilt and returned to service as much as 20 times. Thus the hard-facing program shows a remarkable saving in replacements as well as in downtime, and produces a greater volume of usable, properly sized particles.

Your Stoody dealer would be glad to advise you on the maintenance of your crushers and other heavy equipment subject to costly wear. Check the yellow pages of your telephone book or write to the company for complete descriptive literature.

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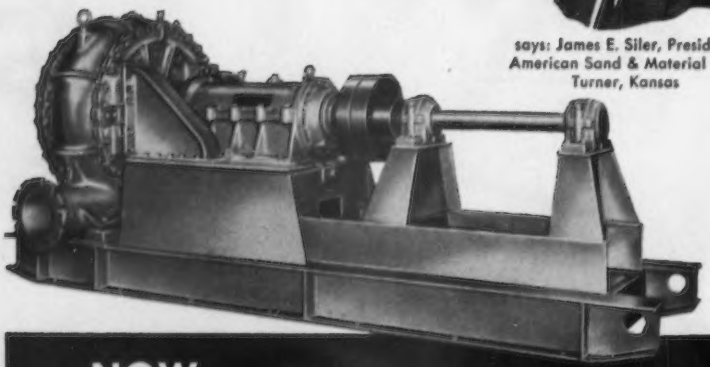
"We Ran Our Morris Pump for 25 YEARS... and then Doubled its Load!"

says: James E. Siler, President
American Sand & Material Co.,
Turner, Kansas



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Oversize Shaft and Bearings — easily withstand vibration and shock loads for longer on-the-line service and lower maintenance costs.

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Economical Impeller Design — insures even wear. An enlarged suction shroud maintains effective pressure balancing and high efficiency.

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Capitol Reef Permits Terminated by AEC

ISSUANCE OF URANIUM prospecting permits in Capitol Reef National Monument, Utah, were halted May 17, 1955, when AEC announced that searches had failed to develop commercial ore during the period of operation under the prospecting permit system. No further permits will be considered and existing permits will not be renewed. Applications for ore extraction contracts from holders of valid permits will be considered.

More Nickel In Offing

AS NICKEL stockpiling and price level decline in the near future, industry will find wider applications for the corrosion resistant metal, according to opinions voiced by officials of International Nickel Co. during a press tour of their Bayonne, N. J., research center April 14.

A new ferrous alloy and two new welding electrodes as well as "tin can" plating experiments with nickel were demonstrated to the editors. A fully automatic pilot plating plant was "unveiled" as the latest addition to the metallurgical research laboratory.

Phosphate Land Sold

APPROXIMATELY 2,000 acres of phosphate land containing almost commercial grade uranium was sold to Shawano Development Corp., New York City, by Louis Egan and Frank C. Thomas, Dallas, Texas, for $4-million in cash and ore payments.

Samples run from the property reportedly showed phosphate to contain 0.05, 0.07, 0.09, 0.04 and 0.10% U_3O_8 and sample run by the USBM showed 0.13% U_3O_8. Phosphate and uranium ores from the property are to be refined through a new process developed by Minerals Refining Co., Salt Lake City.

DMEA Uranium Applications Surpass Previous Records

APPLICATIONS FOR exploration assistance in the uranium field reached a record 117 for the first quarter of 1955, according to Secretary of Interior Douglas McKay. Projects involved in the applications range from a $2,260 operation in North Carolina's mica district to a $523,600 uranium property in Utah.

Total estimated cost of the 113 operators who stated amounts is $7,573,535. Included in the first quarter total is the first DMEA participation in New York State, for a uranium claim near Peekskill, Westchester County.

Royalty payments from 190 certified

Clarence Thom

Henry J. Gisler

Leland Logue

Clifford F. Page

Frank A. Seeton

Henry C. Hurd, Jr.

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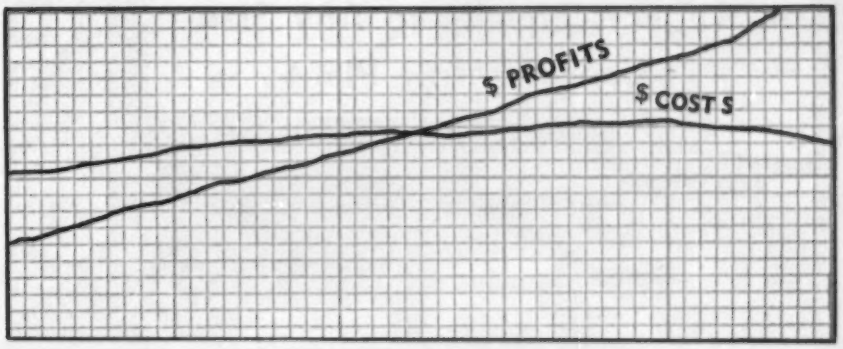

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Send us a small sample by parcel post (10 to 15 pounds is usually sufficient). We will make a preliminary examination at no charge and give you a report on these preliminary findings. These reports supply facts for your future plans. DECO recommendations are accurate, unbiased and thorough. They are based on sound engineering and economic principles and will greatly accelerate the success of your project.

FLOWSHEETS

DECO Engineers will help you work out the flowsheet which will give you an operation that is simple, efficient and most profitable. Many typical flowsheets are at your disposal and may apply to your specific problem.

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Your plant can best be designed by men who have been in that business for many years. After our many years of mill design and operation we have available for use, typical mill designs and mill construction and operating costs. Machine templates will aid you in your layout work. Please write to us about your contemplated plans.

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properties to the Government topped $827,000, McKay said.

Norway Iron Ore Mines Feed Modern Steel Plant

HIGH-GRADE IRON ORE from Sydvaranger and Fosdalens mines will supply the new Mo-i-Rana steel plant in Norway, the first integrated steel producing operation in the country. First stage capacity will be an estimated 170,000 tons of rolled products a year.

Along with taconites from Kirkenes Sydvaranger and the Fosdalen mines, near Trondheim, it is expected that the industry will eventually tap the low-grade iron ore deposits in the Dunderland valley. Limestone will be mined locally.

In conjunction with its Mo-i-Rana plant, Norsk Jernverk A/S has built a 750-ft dock, designed to handle 400,000 tons ore per year; a 2-mile railway from the dock to plant site; 1,750,000 cu ft storage bins capacity; and a sinter plant with 300,000 tons annual capacity.

Inland Starts 5-Year Dredge Job at Steep Rock

TWO GIANT DREDGES, assembled at Inland Steel Co.'s Steep Rock Lake project have begun a non-stop 5-year operation at the Falls Bay arm of the lake to remove 160-million cu yd of glacial silt from the bottom of the property, near Antikokan, Ont.

Dredges, erected by Construction Aggregates Corp., will be operated by the Chicago firm night and day until some time in 1960, removing and returning the water of the lake 12 times, it is estimated, before end of operations. Each dredge houses pumps driven by 10,000 hp electric motors and has two other pumps of comparable size on each line.

P. D. Block Jr., vice president of Inland Steel, said Steep Rock will be mined by both open pit and shaft. Driving of the shaft is scheduled in three years. When in full operation (about 1969), Block said, the mine is expected to produce about 3-million tons of iron ore annually.

Full Scale Production Noted at White Pine

"WHITE PINE COPPER DAYS"—June 9-11 has been proclaimed by chairman L. P. Walsh and his Ontonagon, Mich., committee. Last day of the affair has been set aside to give Morris F. LaCroix, president of White Pine Copper Co., his own "Day."

Nightly pageants, a parade, window displays and a banquet will commemorate the beginning of full-scale copper production at the $80-million project. Modern village, mine, mill and smelter were constructed by co-operative venture of private capital and Reconstruction Fi-

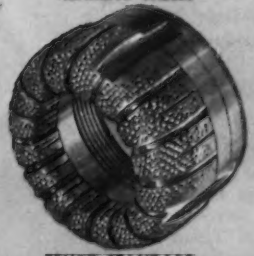
TRUCO CORING BIT

TRUCO CONCAVE BLAST HOLE BIT

TRUCO PILOT BIT

TRUCO IMPREGNATED CORING BIT

TRUCO REAMING SHELLS



TRUCO STANDARD OIL FIELD BIT

FINEST QUALITY DRILL BORTZ

The Man Who Swallowed a Fortune

"Here," shouted Seigneur de Sancy to his bodyguard. "Here are the marks of the melée. Find my poor Pierre and there, I know, you will find the diamond."

When they found the grave in the forest, they found, too, that the brave old retainer, carrying the great jewel to King Henry IV of France (so that he could pawn it to finance his armies) had foiled the robbers at the cost of his life. When his stomach was slit open, there lay the Sancy diamond.

For lending his diamond to France, Henry made de Sancy ambassador to the court of Queen Elizabeth of England, who liked the jewel so much that she bought it. It passed to Charles I, who lost his head on the block, and, later, to James II, who fled to France after a disastrous defeat and sold the Sancy to Louis XIV for $125,000—a fancy price in those days for a diamond of 53½ carats.

During the Revolution, it was stolen with the Crown Jewels of France, found weeks later in a gutter in the Champs Elysées, quickly stolen again, re-discovered in 1828 when it was sold to Prince Demidoff of Russia for $100,000. Today, it is said to be back in India, where it was originally found, probably a thousand years ago.

First cousins to these great diamonds of history are the fine industrial diamonds we import for the manufacture of Truco Diamond Bits. At the drill rig, Trucos provide that irresistible cutting power which takes them through any formation, swiftly, accurately, thriftily, dependably. They save rig time and they lower footage costs. Do you need a new Truco Diamond Bit Catalog?

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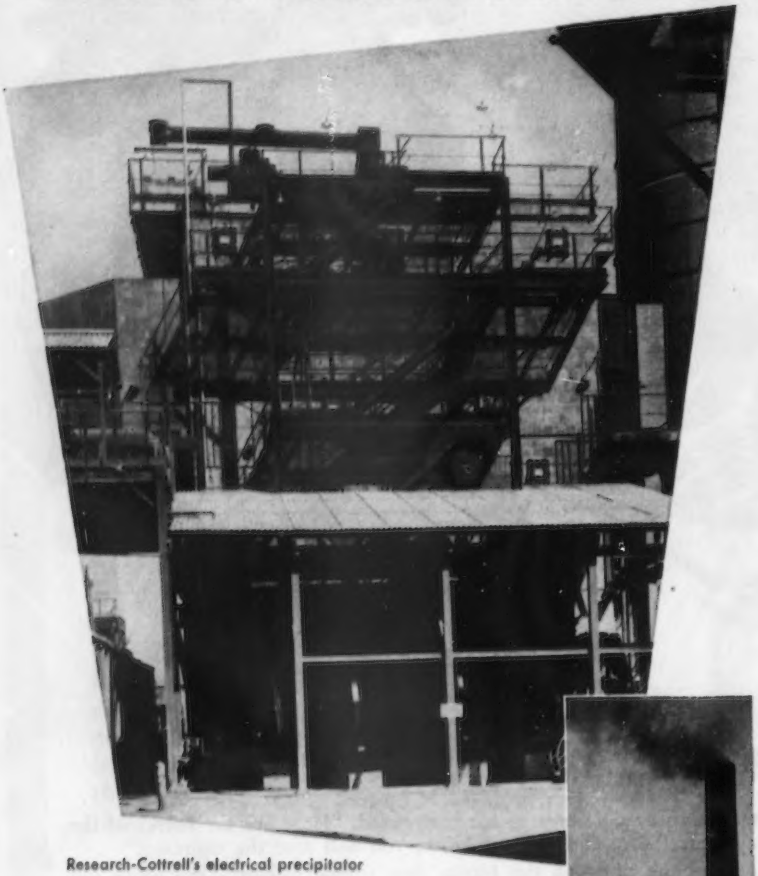

Research-Cottrell's electrical precipitator installation at the Palmerton, Pa. plant.

The two photographs (right) show the results of this Research-Cottrell installation. The smoke in the picture at the top (Precipitator Off) consists of dry dust and fume entrained in the zinc ore sintering machine gases.

The picture at the bottom (Precipitator On) shows nothing but water vapor escaping from the same stack.

If you have a fume problem that involves recovering valuable materials that are going up the stack or combating a smoke nuisance, get in touch with your nearest Research-Cottrell representative. His experience with over 300 roaster and metallurgical precipitators will enable him to advise you on the most effective—and economical solution to your problem.

Precipitator Off

Precipitator On

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nance Corp. Company is now producing 65 tpd blister. This one mine has more than doubled copper production in the Upper Peninsula.

Artificial Diamond Method May Have Other Uses

DR. LEONARDO TOMARKIN AND MARIO VILELLA have announced, from their laboratory near Spring Valley, N. Y., that they, too, can make diamonds using the high pressure (250,000 psi) and high heat (6,000 F) technique; but more important may be the announcement that the process has been used to produce molded tantalum, ceramic metals, molded dense tungsten, and free titanium from rutile. Cost data has not been released but the inventors claim the methods are "highly economical."

IN THE U. S.

ALASKA

Preparations by Quebec Metallurgical Industries, Ltd., are under way for exploration by churn drilling of the placer part of the Klukwan iron deposit near Haines.

Three Anchorage men have staked about 30 more claims in the vicinity of Shirley Lake, scene of a uranium scramble last fall. They report having found further radioactive indications there than were discovered previously, and are hopeful of the existence of a commercial grade deposit.

U. S. S. R. & M. Co., Fairbanks Branch, is now dismantling its recently-purchased dredge at Livengood and plans to move it to the company's holdings at "Hog" (Hogatza) River this summer. Dredge will be trucked to Fairbanks, then shipped 800 miles by water down the Chena, Tanana and Yukon Rivers, then up the Koyukuk River to a point from where it will be again trucked for a short distance to its destination. Company officials hope to be ready for digging in the new location in 1956.

ARIZONA

Mining in parts of the Sierra Ancha Experimental Forest has been closed on order by Interior Secretary McKay. About 8500 acres of Tonto National Forest in the Globe area have been withdrawn.

Four districts, covering 400,000 acres of the San Carlos Apache Indian reservation in east central Arizona have been opened to uranium mining and prospecting. Temporary seven-day permits will be issued by the tribal council. Bidding procedure includes a 30-day period between mailing of advertising data and opening of sealed bids with a minimum

Surveys "Down Under" Added To Aero Operations In Europe, Africa, Near and Far East, South America

Now AERO crews are flying in Australia, in mining exploration surveys over vast desert areas. With the high sensitivity Gulf airborne magnetometer, trained AERO crews are pointing the way for the mining drill, at a fraction of ground survey costs.

"Operation Down Under" adds another important area to the worldwide operations of AERO, the pioneer and leader in aerial surveys. Our crews are now working in the United States, Canada, Africa, Europe, South America, the Near East and Far East.

PLANNING EXPLORATION OR PHOTO-MAPPING? If you are planning exploration or photo-mapping in any foreign areas, contact AERO now. Substantial savings, both in time and organizational costs, may be effected when it's possible to employ AERO crews already in the general area. And our broad foreign survey experience can be extremely helpful to your plans.

35 years and three million miles of aerial mapping experience are at your disposal when you use AERO crews.

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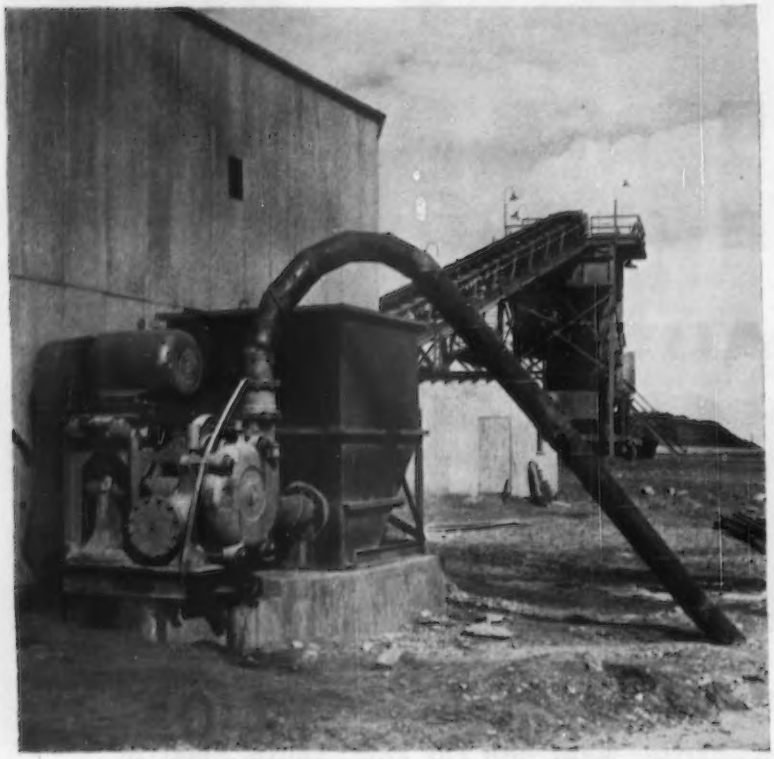
PHILADELPHIA 20, PENNSYLVANIA
Oldest Flying Corporation in the World

OFFICES IN TULSA, SALT LAKE CITY, DULUTH, OTTAWA

GOOD RIDDANCE



To get rid of tailings, excess water and other wastes, you can always count on Naylor Spiralweld pipe. Here's the one lightweight pipe that's built for easier handling and installation without sacrifice of performance strength. And with the one-piece Naylor Wedge-Lock coupling, connections are easier and faster, too. Whether it's air or water—high or low pressure service—it will pay you to look into the advantages of this distinctive lockseamed, spiralweld pipe. Sizes from 4" to 30" in diameter. Thickness from 14 to 7 gauge. Write for Bulletin No. 507 on Naylor pipe and couplings.

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Arizona *(Continued)*

of $25,000 bonus on each of the four units. Biggest bonus gets a one-year prospecting lease and an option lease.

A. P. Morris, general manager, Ray division, has announced four new annual Kennecott scholarships for Ray and Hayden high school students, each for $500. Kennecott also awards an annual $1,000 engineering scholarship for mining seniors at University of Arizona. Kennecott also has made a $5,000 grant to the University for a series of lectures on popular subjects.

Arizona's small mines were a $37.5-million industry in 1954, according to Department of Mineral Resources. Production from small mine operations amounted to 14.22% of the state's total output—an increase of nearly 3% over 1953. Increase was due to more vanadium-uranium and tungsten operations. The industry gave employment to at least 2100 men.

Iron Cap Mine near Globe, closed since 1925, is going to be explored as a possible uranium source. Iron Cap produced more than $9-million in copper and silver before being closed—and it produced pitchblende in two veins at a time when there was no market for it.

Mine is owned by Howard Gentry of Scottsdale, Ariz., Grant J. Pool and R. E. Sutton of Phoenix, and W. D. Riddel of Dateland, Calif.

Pool estimated it would cost $500,000 to reopen the mine. He is vice president of Airborne Exploration Co. of Phoenix. Pool said pitchblende in surface dumps at the Iron Cap assay 13% uranium, and high-grade ore also has been found in shafts.

ARKANSAS

Arkansas state geologist Norman Williams announced discovery of deposits of columbium and uranium ore in the Ouachita Mountain area of Arkansas. Major part of these deposits were in the vicinity of Wilson's Springs and Magnet Cove. Williams said that "on the basis of what is known of columbium content of the rocks in the area, we know there are greater reserves of columbium in central Arkansas than the known reserves of the rest of the U. S."

CALIFORNIA

Verdi Development Co., which holds uranium property in the Mojave-Rosamond area, expects to have its 50-ton mill in operation by July.

Milling and leaching plant, 7 miles from the mine, will convert the ore to a high grade concentrate. Cost of converting the mill, which formerly was used for processing gold, is expected to be $150,000. Contract has been awarded to MacAfee & Co., Los Angeles.

C. Hyde Lewis, whose New Idria Min-

We bought a $60,000 saving!

All pertinent facts *in the following story are backed by information revealed in an actual case history. We have chosen not to identify the operation because of an understandable reluctance to disclose intimate production details.**

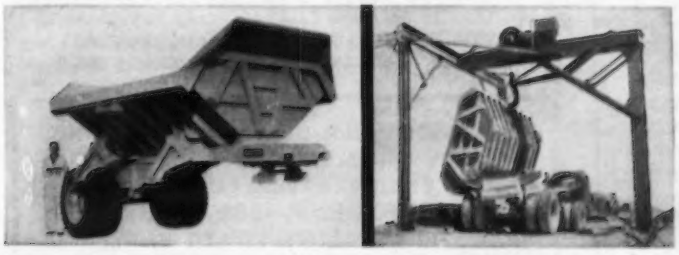
A YEAR AGO we put six new EASTON pan type trailers into service in one of our quarries. The EASTON equipment was chosen on a strictly competitive basis with cost-per-ton a dominant consideration.

Our purchasing study indicated a potential saving of about two cents per ton against the nearest competitor, and our records during the first year of operation show an even lower cost than we had anticipated.

At one of our other plants we have had EASTON trailers in day-to-day service for more than four years, with virtually no maintenance and still going strong. Supported by the facts now available at both operations we believe we are conservative in estimating a saving of two cents per ton over other equipment which might have been selected.

Over a period of five years the six trailers at the new plant will haul more than three million tons. That is why we say we bought a $60,000 saving when we bought EASTON.

YOU CAN'T BEAT THIS COMBINATION!



It's the famous EASTON doorless pan trailer and exclusive EASTON electric overhead dumping system. Dependable overhead dumping is *essential!* Trailer capacities, 10 to 36 tons.

***You are invited to check the cost question with any user of EASTON equipment. Also, EASTON will always welcome an opportunity to make a competitive survey when the aim is to provide a better transportation system for mines or quarries.**

EASTON®

EASTON CAR & CONSTRUCTION COMPANY • EASTON, PA.

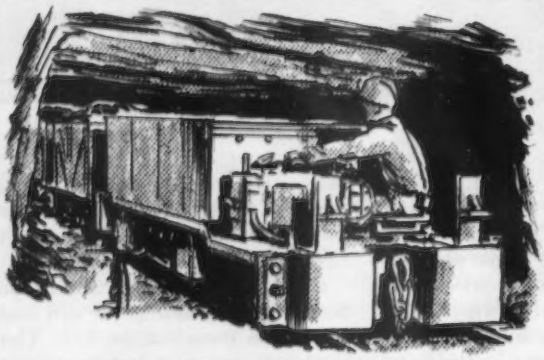
FACTS ABOUT Exide®

IRONCLAD® MINING BATTERIES

NEW WAY TO CUT COSTS, BOOST PRODUCTION...

TWO-WAY MINE TRACTOR SERVICE ...DEPENDS ON EXIDE-IRONCLAD POWER!

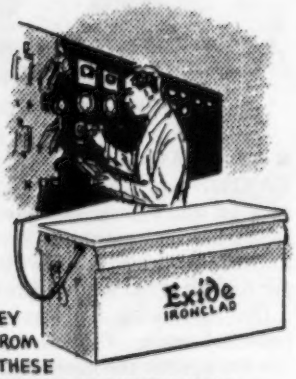
LOOKING FOR A WAY TO CUT PORTAL-TO-PORTAL TRAVEL TIME 50%...TO MOVE SUPPLIES AND EQUIPMENT WITHOUT HALTING THE NORMAL FLOW OF PRODUCTION? EXIDE-POWERED RUBBER-TIRED TRACTORS AND TRAILERS, LIKE THE KERSEY TRACTOR SHOWN, DO SERVICE JOBS FASTER... SAFER...AT LOWER COST. USE TRACTORS-POWERED WITH LONG-LIFE EXIDES FOR FAST, LOW-COST HAULAGE!



MORE TRIPS PER SHIFT! WITH DEPENDABLE EXIDE-IRONCLADS...

CAR CHANGES ARE SPEEDED, LOADERS KEPT BUSY, AND HAULAGE MOVES FAST WHEN LOCOMOTIVES ARE POWERED WITH EXIDE-IRONCLADS. EQUIPMENT WORKS FULL-SHIFT, DOWN-TIME IS ELIMINATED. YOU GET MORE PRODUCTION PER MAN-HOUR WITH LESS COST PER TON HANDLED. DEPENDABILITY AND LONG USEFUL LIFE MAKE EXIDE-IRONCLADS YOUR BEST POWER BUY-

AT ANY PRICE!



WORKED TO DEATH TO LEARN SECRET OF LONGER LIFE...

LAB TESTS OF IRONCLADS AGAINST CONVENTIONAL BATTERIES SHOW THAT THEY PERFORM BETTER... HAVE FROM 20% TO 30% LONGER LIFE! THESE FACTS, DEMONSTRATED BY THOUSANDS OF BATTERY USERS, EXPLAIN WHY EXIDE-IRONCLADS ARE YOUR BEST MINING BATTERY BUY-*AT ANY PRICE!* SINCE 1910, RESEARCHERS HAVE GREATLY IMPROVED EXIDE-IRONCLAD PERFORMANCE AND USEFUL WORKING LIFE, BUT THE BASIC IRONCLAD PRINCIPLE OF TUBULAR CONSTRUCTION REMAINS THE SAME.

LET EXIDE HELP SOLVE YOUR MINING BATTERY PROBLEMS. ❶ CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS. ❷ WRITE FOR FORM 1982, A MANUAL ON MAINTAINING MOTIVE POWER BATTERIES.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

California *(Continued)*

ing and Chemical Co. provides Verdi with management advice, said exploration at the Rosamond properties has disclosed a definite fissure vein 1,000 ft long. Crosscuts 100 ft wide have been dug at two points near the surface, and findings indicate the deposit changes from secondary ore at the surface to primary ore at depth. He said Verdi is negotiating for a quarter section adjoining the property it now owns.

New Idria Mining and Chemical Co. has set 125 tpd as production goal for its Strawberry tungsten mine and mill 75 miles northeast of Fresno. M. C. Richardson, general manager of the Strawberry division, will be in charge of operations on the site. Palmer Deines heads the Fresno office.

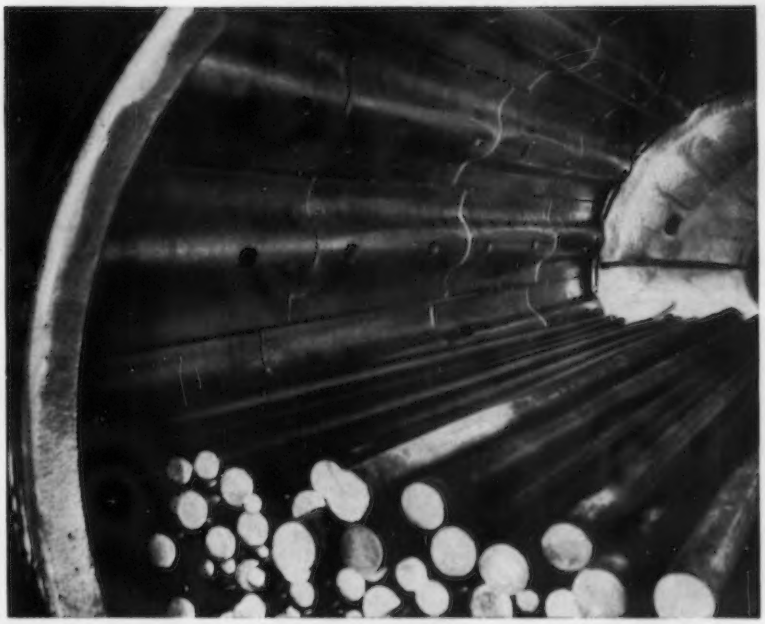
FLUE FROM THE ROASTER-KILN Building has been connected to the 637-ft chimney as construction speeds toward a fall opening of International Nickel Co.'s new iron ore plant near Copper Cliff, Ontario. The $16,000,000 initial unit will treat 1,000 tpd nickel-bearing pyrrhotite removed from ore in the early stages of processing at Inco's huge Copper Cliff reduction works.

New quicksilver find in Redwood City, on the San Francisco Peninsula, has been leased by Hal Piggott of Piggott Projects, San Francisco, on a royalty basis. Deposit is located on property owned by a building firm.

Piggott said the ore averages 12-15 lb quicksilver to the ton. It occurs in silica-carbonate rock, altered serpentine.

Bulldozing done by Bauman Brothers of San Carlos under contract has extended ten 12-ft trenches about 120 ft and a crosscut 32 ft. Quicksilver showings extend to the surface.

Battle over management of Yuba Consolidated Gold Fields, Inc., nation's second-largest gold producer, broke into open when stockholders received letters



THESE ABK® METAL LINERS HAVE ALREADY GROUND OVER 300,000 TONS OF ORE

These ABK Metal Mill Liners have already ground more than 300,000 tons of tough Ilmenite-Magnetite ore—and they are expected to give at least twice this much service before they have to be replaced!

In service at Tahawus, N. Y., in the world's largest titanium ore mining operation, the liners are installed in a 6x12 Marcy Open End Rod Mill which is in a closed circuit of rod mills and vibrating screens. Ore is ground to a −28 mesh.

As in the case of the National Lead Company, who owns and operates the mine and has made extensive tests on liner life, you can expect as much as 3 to 4 times more life from ABK Metal Liners than from those made of ordinary iron. That's because ABK Metal features a controlled Martensitic structure, extreme hardness (Brinell ranges from 500 to 700) with an unusually high resistance to abrasion. A Brake Shoe exclusive, these nickel-chrome iron liners will cut your replacement, maintenance and downtime costs as well as increase mill efficiency.

For full details on ABK Metal Mill Liners, Grinding Balls and other wearing parts, contact American Brake Shoe Company, Dept. A, 230 Park Avenue, New York 17, N. Y.

AMERICAN Brake Shoe COMPANY

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BRAKE SHOE AND CASTINGS DIVISION

230 Park Avenue, New York 17, N. Y.

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**T.M.—E. I. du Pont de Nemours Co.
***T.M.—Reg. U.S. Pat. Off.

As manufacturers of an extensive line of Filter Cloths our analysis of and recommendations for your filter cloth problems will be unbiased . . . we have "no ax to grind" regarding any particular cloth.

Each of the cloths listed above offers different operating advantages. Each type has its own range of chemical resistance, its own temperature limits and its own degree of resistance to moisture, molds, fungi and bacteria. With such a variety we are in position to recommend a filter cloth that will give you the best service for your particular application.
In writing for literature and test samples please tell us about your problem.

. . . for your Filter Paper requirements try NETONE Filter Paper. High tensile strength, high burst factor, abrasion resistant, crease resistant and chemical resistant. Send for a test sample.

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California *(Continued)*

soliciting proxies for a new slate of directors.

The letters were signed by B. F. Pitman Jr. of San Antonio, who proposes "repatriation" of the management to California, where principal gold dredging properties are located. He urges replacement of the present directors.

Pitman asked stockholders to vote for "more adequate representation for western shareholders, who account for two-thirds of the total number."

He maintains "absentee management" was a contributing factor in "losses amounting to some $3-million" suffered by the company through a gold mining venture at Round Mountain, Nev., and settlement of flood damage claims on the Yuba River. He also claims the management releases inadequate information to stockholders.

Answering Pitman's assertions, Yuba president Marshall G. Bolster declared $42.5-million has been disbursed to stockholders in company's 50 years of operation, "a record which speaks for itself and for efficient management."

He adds, "Mr. Pitman's real interest for some time has been to merge (Yuba) to his International Mining Co."

Annual meeting is slated for June 7 in Portland, Me. Proxies are being solicited by both factions from holders of the 2,211,950 shares outstanding.

COLORADO

Mott Core Drilling Co., Grand Junction, has been awarded three core drilling contracts totaling 113,000 ft by AEC and USGS on the Colorado Plateau:

AEC—Bull Canyon Area, Montrose and San Miguel.

USGS—Deer Flat, Utah, and roving contract, to be carried out in Colorado, Utah and Arizona.

Core drilling for AEC has started in Bull Canyon.

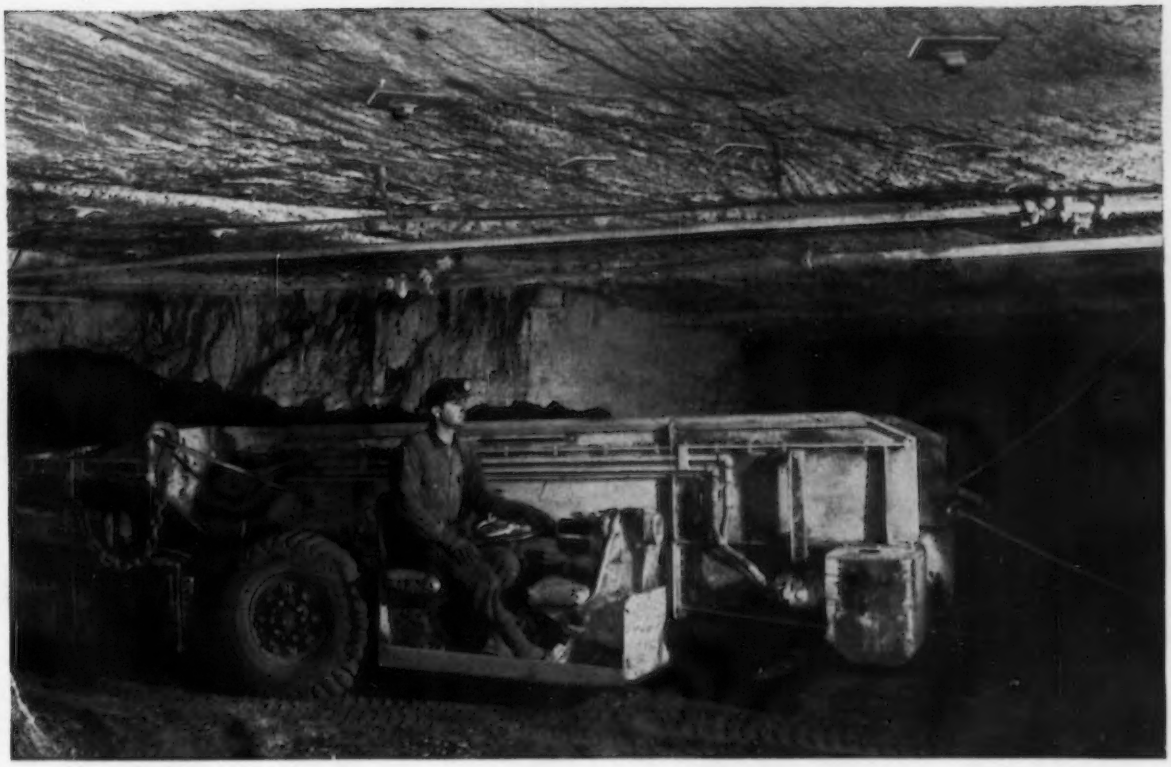
American Uranium Engineering Co., subsidiary of the New-Mar Uranium Corp., has reached the bottom of a 425-ft vertical shaft on Beaver Mesa in the Gateway district.

Ralph F. Simpson, president of both American Uranium Engineering and New-Mar, said ore production would begin as soon as surface installations were completed.

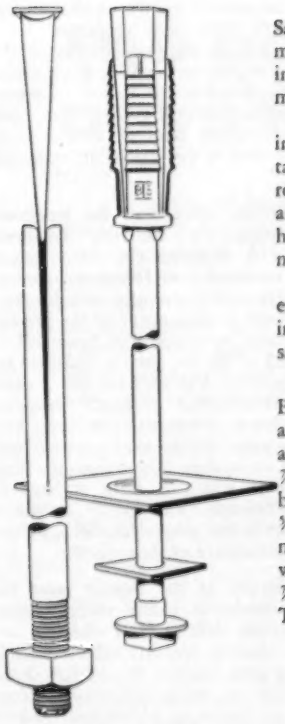
Colorado Mining Assn. has opened a branch office in Grand Junction "to give more complete service to the rapidly growing uranium industry of the Colorado Plateau."

Manager of the Grand Junction office will be Dean P. Hansen, former manager of the Cortez Chamber of Commerce and a Western Slope native.

Mines Development, Inc., of Denver, signed a contract April 28 with the Atomic Energy Commission for construction and operation of the long-awaited uranium processing mill to serve western South Dakota and eastern



You Gain Elbow Room When You Roof-Bolt



Safety is, of course, the No. 1 reason for using mine roof bolts. The bolts consolidate strata into a single-unit thick beam, which effectively minimizes the possibility of serious roof falls.

But roof bolts bring other benefits too—including a big gain in elbow room. When you take out old-fashioned, bulky supports and replace them with modern roof bolts, you automatically gain a lot of extra space. You have larger free areas in which to operate mechanical equipment.

Bethlehem makes four types of roof bolts, each designed to help operators obtain these improved working conditions, and increased safety.

SQUARE-HEAD BOLTS (Three Types)

Bethlehem makes a ¾-in. carbon-type roof bolt, and a ⅞-in. high-strength roof bolt, each with a typical breaking load of 24,000 lb. Also a ⅞-in. high-strength roof bolt with a typical breaking load of 45,000 lb. Both the ¾-in. and ⅞-in. roof bolts can be used with Bethlehem's matching-halves Type F expansion shell, or with the 4-leaf Type C expansion shell. The ⅞-in. roof bolt is intended for use with the Type F shell only, in a 1½-in. hole.

HARDENED WASHERS. Bethlehem makes several sizes of hardened washers for use with headed roof bolts. The washers reduce the friction between the bolt head and roof plate which occurs when high tension in the bolt produces excessive bearing pressure. When this washer is used, there is no danger of galling or tearing of metal with pneumatic impact wrenches.

SLOTTED BOLT. This bolt, 1 in. in diameter, has a centered slot which is made by forging. No metal is lost in the forging operation. Opposite end of bolt has 5 in. of rolled threads. Bolt is supplied with steel wedge, which is started in slot when bolt is placed in hole. When bolt is driven in 1¼-in. hole, wedge is forced deep into slot, expanding the bolt-ends. Truncated-cone point prevents damage to threads. Bolt is normally furnished with American Standard Regular Square Nut.

BETHLEHEM STEEL COMPANY

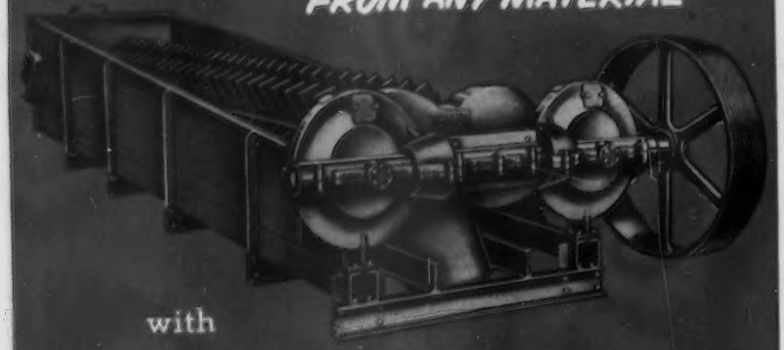
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Remove TOUGH CLAY, SOFT ROCK AND REFUSE FROM ANY MATERIAL



with

McLANAHAN LOG WASHERS

McLanahan Welded Steel Log Washers are smooth running, highly efficient machines for removing tough clays, soft rock and other materials from iron and manganese ores, barytes, zinc, ochre, peat, limestone, trap rock, sand and gravel, phosphate, gold and other ores. These machines remove high percentages of undesirable refuse—providing savings that more than pay for the installation in a very short time. A few of hundreds of applications are illustrated below.

TYPICAL INSTALLATIONS OF McLANAHAN LOG WASHERS

Two pairs of 30' McLanahan Logs, used for cleaning sand and gravel in Virginia.

McLanahan Paddle Mill and Log Washer cleaning Texas limestone.

Write Today for Bulletin WLO-1253

New and old type McLanahan Log Washers used here remove clay from cement rock in Pennsylvania.

McLANAHAN & STONE CORPORATION

PIT, MINE AND QUARRY EQUIPMENT HEADQUARTERS SINCE 1835

255 Wall Street, Hollidaysburg, Pennsylvania

Colorado *(Continued)*

Wyoming." (See *E&MJ*, May 1955, p 75.)

AEC said the new mill will be owned and operated by Mines Development, and will provide processing facilities for Black Hills region ore. Production of that area has been stockpiled at the Government-owned ore-buying station at Edgemont since late in 1952.

Superintendent A. C. Hilander of Telluride Mines forecast full production by Jan. 1, with 325 men employed. Remodeling of the old mill will be completed about Oct. 1, Hilander said, with capacity almost doubled by use of power equipment. In the mines, old 40-pound track is being removed and 60-pound track installed. Diesel mine locomotives will replace electric units used in the past.

Continental Uranium, Inc. disclosed it is negotiating with the AEC for use of the Burwell process in treating uranium ores.

New process anticipates operating milling plants in the field close to the source of ores. Process is owned by Blair Burwell, Raymond Sullivan, Minerals Engineering and the Gidwitz interests.

It is understood a 200-tpd plant using the Burwell process is being considered by Continental for processing ores at the firm's Rattlesnake and Lisbon No. 1 mines in San Juan County, Utah.

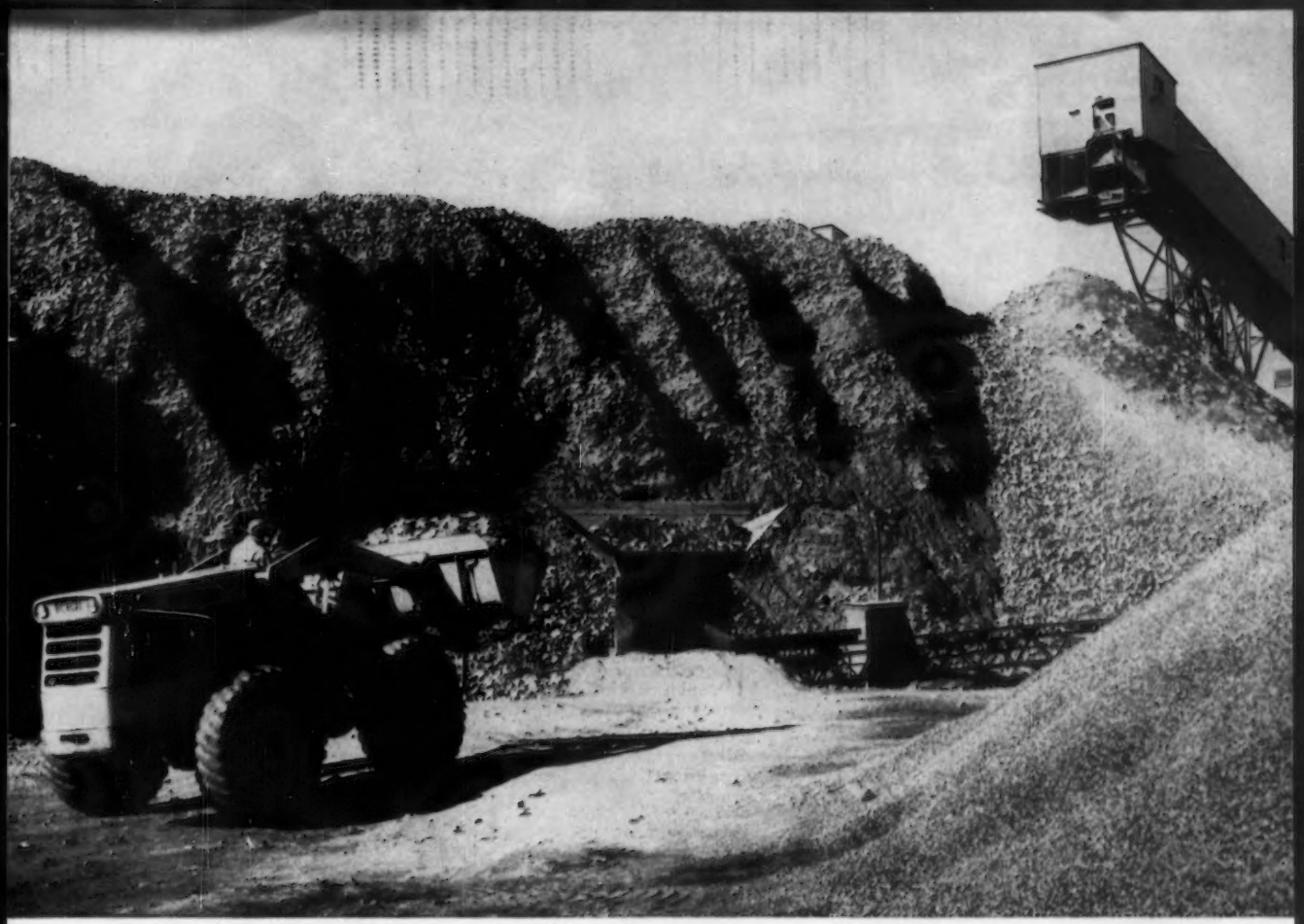
Lucky D Uranium Mining Co. of Cortez produced 570 dry tons of uranium-vanadium ore in the three months ending March 31.

Vice president Dale Dillon and two miners accounted for the production on Lucky D's Slick Rock property.

Lucky D also has completed over 22,000 ft of drilling on the Slick Rock. Company has opened up the Yellow John orebody in San Juan County, Utah, and said that "when feasible, this orebody will be mined at the rate of an estimated 100 tpd."

At Leadville, officials of the Resurrection Mining Co. and the American Smelting & Refining Co. have agreed upon a modest 12- to 15-month program for coordinated exploration and development of the ground north of the present Resurrection workings from Iowa Gulch, and south of the ore already disclosed by workings from AS&R's Irene No. 2 shaft of its Ibex-Sunday project. Program contemplates connection of the Yak Tunnel with AS&R shaft, which will then be drained by pumping to the Yak level, after which a drive is contemplated beneath the Irene orebodies southerly in the general direction of the Hellena workings of Resurrection.

Gold receipts at the Denver mint for March continued below corresponding 1954 figures while silver receipts remained sharply higher. Mint officials reported gold receipts for March down to 84,085 oz worth $2,943,006 from 97,114 oz valued at $3,398,990. Silver receipts were up to 734,670 oz worth



This 2¼-yd. MICHIGAN loads over 1000 tons of ore per day . . .

The bonus in the bucket pays for this machine fast!

Take another look at the bucket in the photograph. It shows a typical MICHIGAN* bucket-load, heaped-up well over the rated capacity of the bucket—nearly a 50% bonus. Translate this bonus into your daily production and you'll see why a MICHIGAN Tractor Shovel pays for itself fast: you simply move more material with a MICHIGAN.

Tremendous digging ability. Get the bucket blade into hard-to-dig material or under a heavy obstacle and "work" the bucket until you've got a heaping load. The two double acting bucket cylinders are actually powerful enough (if the blade is under an immovable object) to pull the back wheels off the ground! We'll match the MICHIGAN'S digging ability against any make or type of Tractor Shovel, bar none.

Low-level bucket action. You can roll the bucket back only a few inches off the ground—heaping bucket-loads even when the material is scattered only a few inches high. And you can carry the full load *low*—your driver can *see* where he's going, he doesn't have to travel *backwards*.

No clutch—faster cycles. There's no clutch pedal on a MICHIGAN. You can actually shift between Forward and Reverse *while moving:* simply push the hand-lever on the steering column—MICHIGAN'S power-shift transmission shifts instantly. Power-shifting saves time and energy every cycle. Your operators will say: "This sure beats riding a heavy-duty clutch all day!"

See it in action—on your own job. Write us and we'll arrange a demonstration. MICHIGANS are built to handle jobs too tough for other rubber-tired Tractor Shovels—*let us prove it*, without obligation. Write for details on the pay-as-you-go MICHIGAN Lease Plan—you can put these machines to work without laying out a penny of capital.

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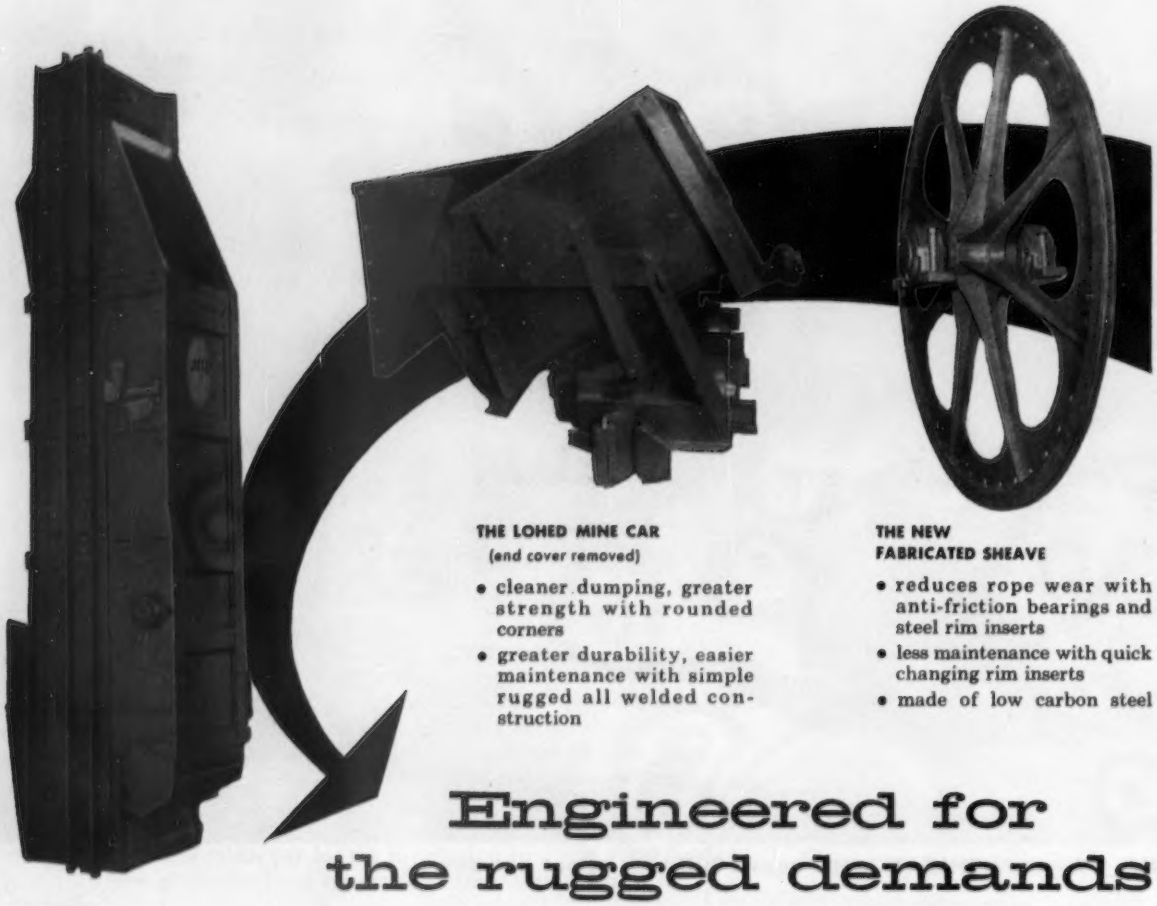

THE LOHED MINE CAR
(end cover removed)

- cleaner dumping, greater strength with rounded corners
- greater durability, easier maintenance with simple rugged all welded construction

THE NEW FABRICATED SHEAVE

- reduces rope wear with anti-friction bearings and steel rim inserts
- less maintenance with quick changing rim inserts
- made of low carbon steel

THE "JETO" BOTTOM DUMP SKIP

- less dead load, greater pay load with lightweight aluminum and steel construction
- increased production with cleaner faster dumping action
- Lighter less expensive headframe construction due to greatly reduced headframe travel
- greater safety with positive dumping action and body safety latch

Engineered for the rugged demands of metal mining!

For close to 100 years Lake Shore has focused its seasoned engineering attention on developing equipment to make metal mining operations more efficient and safer. Excellent results of that continuous effort are the "Jeto" bottom dump skip, the new fabricated sheave, and the all welded "Lohed" mine car; useful developments that have achieved increased production, lower maintenance costs, and longer equipment life for the metal mining industry. Write for detailed product bulletins.

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Plants: Iron Mountain and Marquette, Michigan

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Underground cars • skips • cages • trestle cars • sheaves
grizzlies • snatch blocks • hoists • mills • special equipment

*A Trademark of Clark Equipment Company

Colorado *(Continued)*

$664,812 from 276,138 oz worth $249,803.

Sinclair & Hildreth Mines, Inc., Kansas City coal mining company, has opened offices in Gunnison to engage in uranium mining.

At Cresson gold mine, second largest tonnage producer in the Cripple Creek district, work had been hampered on the 22 level by a large flow of water, but situation has been corrected by extending the Cresson lateral from the main Carlton drainage tunnel towards the Cresson mine. There have been several orebodies opened up to the bottom, or 22 level, which are reported better to date than those found on the 20 and 21 levels.

Callahan Lead-Zinc Co. says that although lead-zinc prices increased at year's end, they did not reach levels required to justify resumption of operations at the Akron Unit. It is considered that this property should remain inactive until there is good basis for believing that the combined price for one pound of lead and one pound of zinc will exceed 30c for at least a year. Thirteen more claims were located near Gunnison, following aerial surveys which indicated areas of radioactivity. Property was subsequently leased to Vulcan Silver-Lead Corp. of Idaho in conjunction with a general agreement under which Vulcan will undertake all uranium exploration with Callahan retaining the right to purchase a 20% participation in any uranium operation developed by Vulcan.

Shipments of uranium ore are being made from the Dallas Uranium & Oil Corp.'s Jody Mine at Gateway, it was announced. Ore is being stockpiled between shipments. Additional drilling on this property indicates, the company says, that approximately $100,000 in ore is blocked out and that considerably more ore is indicated. Company is also drilling on five additional properties in Utah and Colorado, which were obtained on farmouts from Consolidated Uranium and others.

IDAHO

Clayton Silver Mines, Sunshine Consolidated, Inc. and Silver Syndicate Inc. have joined forces for a long-term exploration venture. Each company has agreed to put up $10,000 a year for 10 years to finance the program, and an exploration division has been established in the Clayton firm to carry out the search for new mineral resources.

As an initial venture the group has acquired state leases on approximately 430 acres in Lemhi County and 7,300 acres in Custer County, reported to have good potential for uranium and other minerals. Norman M. Smith, directing engineer, is investigating the Colorado Plateau area for other promising prospects. All three companies are headed by W. M. Yeaman of Yakima, Wash.,

HOFFMAN Leads Again With New Bit Designs . . .

"ORIENTED DIAMOND-MINIATURE" CORE BITS and REAMING SHELLS

. . . for Uranium Prospecting

Another example of how Hoffman "Designs The Bit To Fit The Job", these new Miniature Core Bits and Reaming Shells can be operated from a ¼ h.p. motor.

They eliminate bulky rigs—reduce prospecting time and labor. Just as with the other Hoffman Bits shown here, Miniature Bits are set with oriented diamonds. They cut on a negative rake to produce clean, smooth cores that permit accurate identification of any formation with less power consumption and lower footage costs.

DIAMOND CORE DRILLING SINCE 1902

Leading contractors in exploratory and grout-hole drilling and pressure grouting for more than half a century, Hoffman Bros. are equipped to save you money on your next drilling job.

Write for FREE Price List

HOFFMAN BROS. DRILLING CO., Inc.
Tiona St. (Ext.) Punxsutawney, Pa.

These are terms that JKS engineers are concerned with 24 hours a day in the design and manufacture of Diamond Drill Bits that suit your coring and drilling qualifications to a "T".

Throughout years of steady progress these standards were the basis for the drilling bits that are now recognized as unbeatable the world over.

HARDHED matrix for non-abrasive formations
HARDHED 40 matrix for average drilling conditions
HARDHED 55 matrix for extremely abrasive formations

When you next need a diamond drill bit which no formation will slow up, gives full core recovery, faster penetration *AND* saves you *days* and *dollars* in coring and drilling, contact your nearest J. K. Smit field representative or write us direct for literature and assistance.

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
MURRAY HILL NEW JERSEY
Additional plants in London, Paris, Amsterdam and Toronto, Canada

Idaho *(Continued)*

and their boards of direcctors are interlocked.

Stockholders of Highland-Surprise Consolidated Mining Co. have approved an operating agreement under which Sidney Mining Co. will explore and develop the Highland-Surprise property in the Pine Creek area of the Coeur d'Alene District on a profit-sharing basis from the new 2300-level of the Sidney shaft, now being deepened to that horizon.

Highland,. meanwhile, will turn its attention to development of its promising new lead-zinc-silver prospect in the Fourth of July Canyon area of Custer County and its uranium property in the Henry Mountains area of Garfield County, Utah, a joint venture with New Silver Bell Mining Co., Almira, Wash.

First eight holes drilled on the Utah property have proved a mineralized channel at a depth of less than 200 ft and further drilling will now determine whether the channel contains ore in commercial quantities.

Sunshine Mining Co. has opened a new vein of silver-copper ore in the hanging-wall of the Silver Syndicate fault structure about midway between the East and West Rambo stoping areas. It is a narrow structure, but is the most encouraging ore mineralization thus far found in this relatively unexplored portion of Syndicate property. Development to date indicates that the vein is angling toward the fault.

Sunshine operates Silver Syndicate property under a profit-sharing agreement.

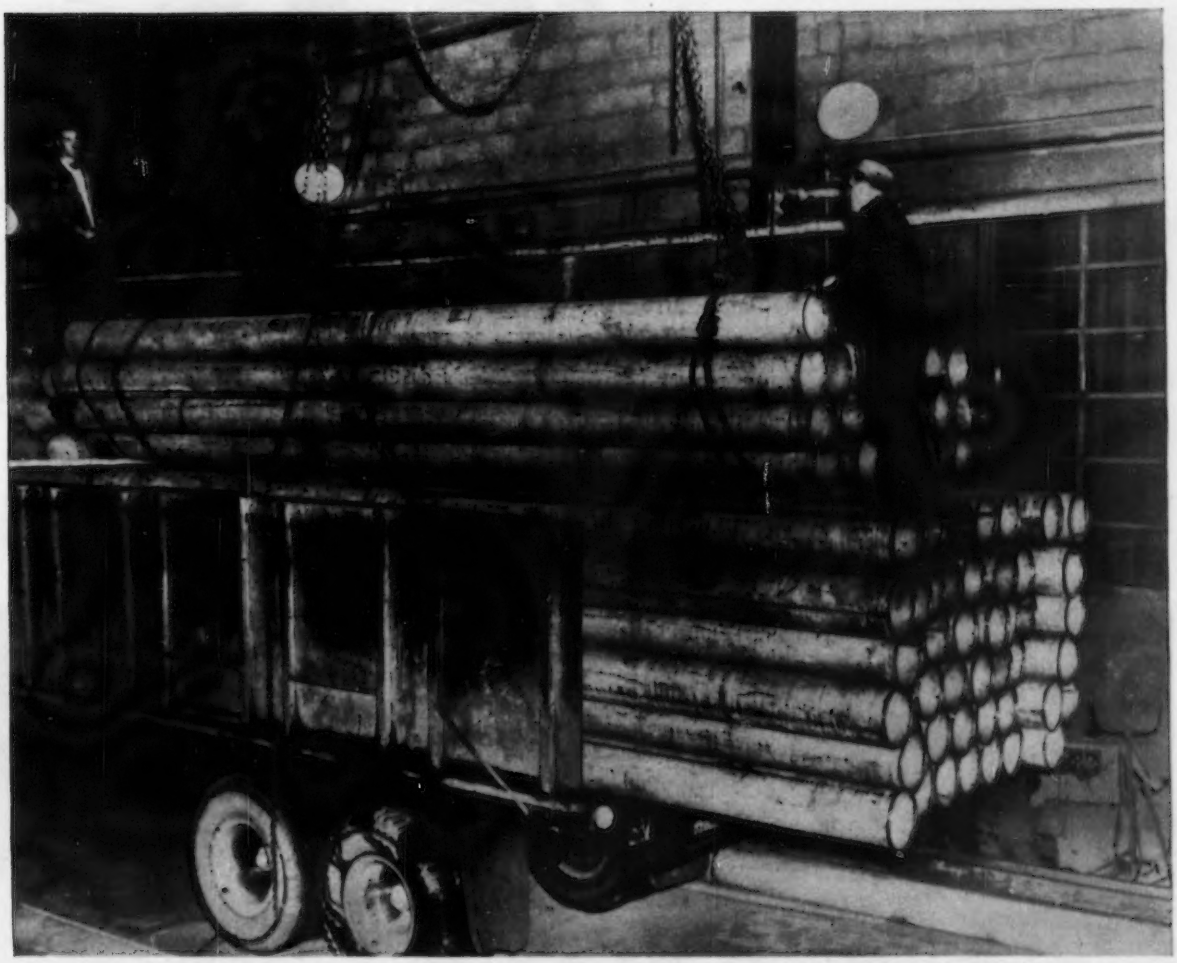
National Uranium Co. of Idaho reports encouraging results on two of its uranium exploration ventures.

At the 43-claim Jarwell property southwest of Grand Junction, Colo., a joint venture with Pathfinder Uranium of Salt Lake City, a clearly-defined mineral channel carrying values as high as 0.1 and 0.2% uranium oxide has been indicated by the 32 test holes completed to date. Efforts are now being made to negotiate operating agreements with the owners of adjoining claims.

First test hole on the two-claim Mountain Lion property in the Big Indian District of San Juan County, Utah, has intersected a one-foot thickness of ore at a depth of approximately 720 ft. Exploration is being done under a 60-40 profit-sharing agreement with Silver Buckle Mining Co.

Mascot Mines Inc. has resumed development work at its Little Pittsburg mine in the Pine Creek District of the Coeur d'Alenes. A crosscut toward the main zinc-lead vein is now in progress on the No. 10 level where a station and pocket were completed before operations were suspended in August 1953 because of low metal prices.

Clayton Silver Mines has started production from the south orebody on the new 550 level at its mine in the Bayhorse District of Custer County. Big north orebody is expected to be reached by July



Several Mines now use stainless steel piping as the most economical answer to the mine water corrosion problem. Steel for this load of Type 304 chromium-nickel stainless piping was produced by Atlas Steels Ltd., Welland, Ont.

Mine water leakage stopped by Stainless Steel

DISPOSAL OF MINE WATER . . . a continuous operation where sub-surface streams and springs keep flowing . . . often involves repair work and expense.

Really big trouble comes from pipe leakage.

Impurities such as iron pyrites turn water into highly corrosive media that rapidly destroy ordinary piping. And that means replacements.

For a practical way to stop this leakage, labor and expense, look above. The load of pipe you see is Type 304 stainless for use in a Canadian metal mine. In 40-foot lengths, this thin walled chromium-nickel stainless weighs only 480 pounds . . . against 1250 pounds for standard I.P.S. carbon steel pipe.

You'll never worry about leakage due to corrosion from most mine waters, when Type 304 stainless is on the job. Pipe of this sort gives you one of the strongest, toughest and most economical means for disposal.

Half a mile of Type 304, with a 10" outside diameter and a .109" wall thickness, weighs about 17 tons. Yet it withstands 130 p.s.i. working pressure and static pressures up to 240 p.s.i. It's another example of the way nickel alloys provide greatly improved properties without adding bulk or deadweight.

Whenever you have a difficult metal problem, let us show you how a nickel alloy can do the job the way you want it done. Make use of our wide practical experience in the mining field. Write for "List A" of our publications. It includes a simple form that makes it easy for you to outline your problem.

INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

INTEGRAL TYPE — Designed for production drilling, the Integral Type is used in combination with the CP-32 AW Sinker for general Airleg work and the CP-59W Sinker for the harder formations and deep-hole drilling. Available with feed cylinder of aluminum alloy. Has push button release at both ends of the sinker handle.

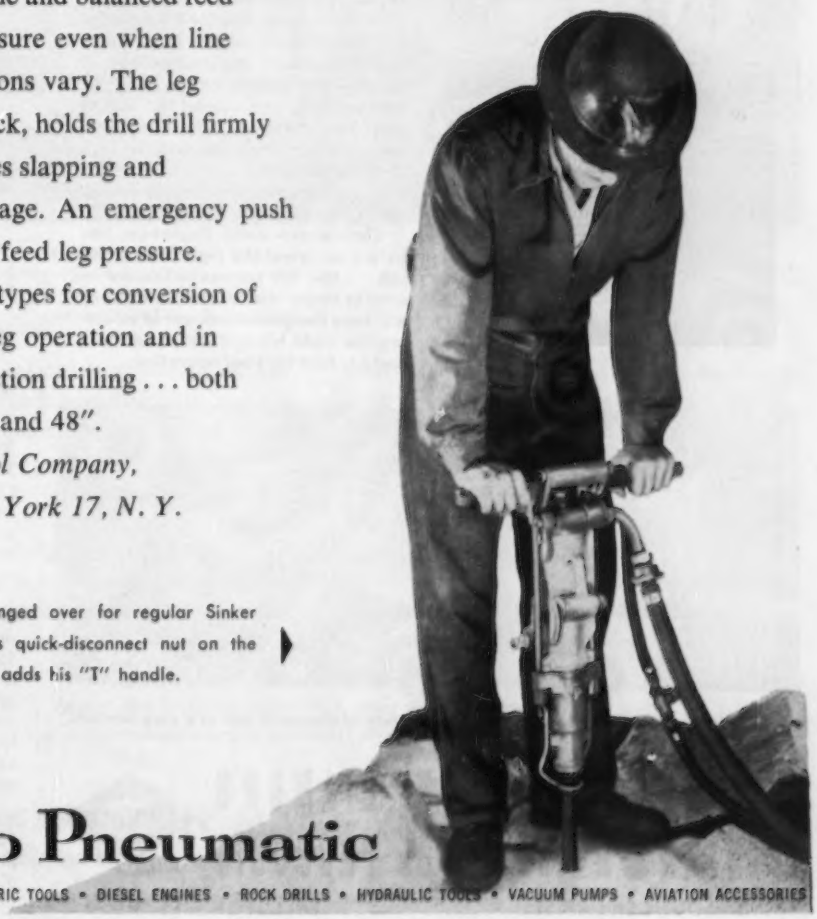
these two CP

ATTACHABLE TYPE—Converts standard CP Sinkers for lateral or overhead drilling. Used with the CP-39 Sinker for soft to medium formations; the CP-32A Sinker for general Airleg work; the CP-59 Sinker for hard formations or deep-hole drilling. All sinkers recommended for use on Attachable and Integral Airlegs are available with optional hooded front head that reduces weight and prevents chuck spray.

Airlegs make every bit count!

That's right! CP Integral and Attachable Airlegs get the most out of efficient Tungsten Carbide bits. Here's why: CP Airlegs' exclusive pressure release type control handle and balanced feed leg apply steady bit pressure even when line pressure or rock formations vary. The leg takes constant recoil shock, holds the drill firmly to the work . . . eliminates slapping and reduces costly bit breakage. An emergency push button instantly releases feed leg pressure. Available in *Attachable* types for conversion of standard sinkers to Airleg operation and in *Integral* types for production drilling . . . both in standard feeds of 36″ and 48″.

Chicago Pneumatic Tool Company,
8 East 44th Street, New York 17, N. Y.



INTEGRAL TYPE is quickly changed over for regular Sinker drilling. Operator simply loosens quick-disconnect nut on the Airleg, dismounts the Sinker and adds his "T" handle.

Chicago Pneumatic

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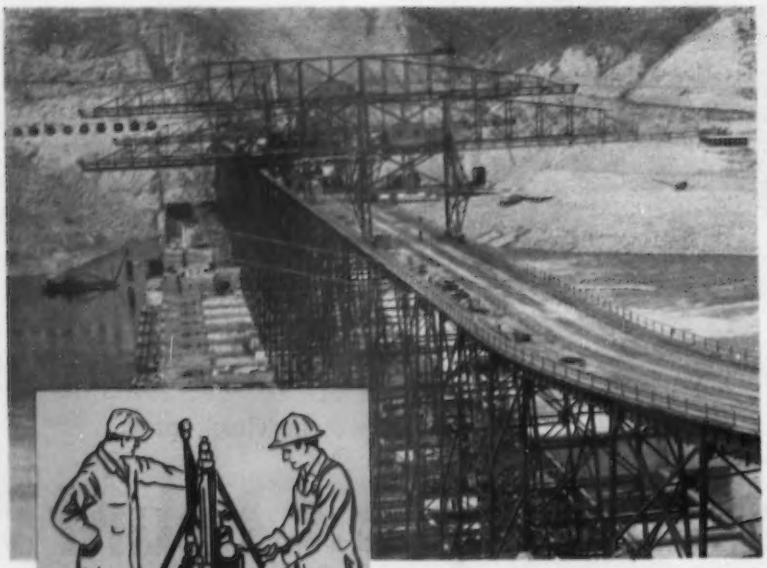
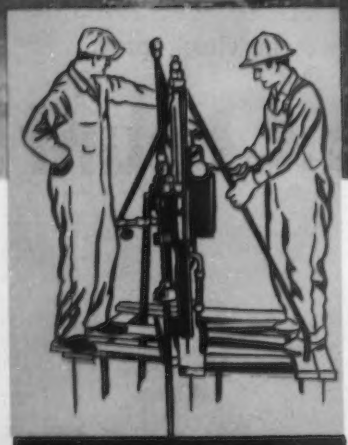
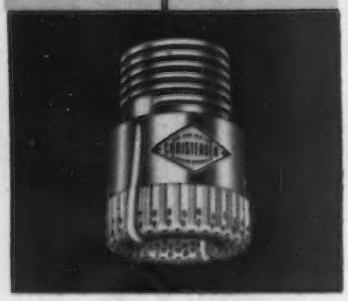






Foundation Testing With

Christensen Diamond Core Bits

100% core recovery is an absolute necessity on jobs such as those shown here. From cores obtained the geologist can determine the location of faults, evaluate the percentage of seepage and determine the ability of the foundation to support the tons of steel and concrete. Less than 100% core recovery could result in the lack of vital information which means time and money consuming delays while new cores are being taken.

Christensen Field Engineers can help you select the right bit for the job . . . the bit proven effective in similar rock. His recommendations will take the guesswork out of selecting the right bit and will mean less cost per foot for your operation.

Write for our latest catalog describing a variety of diamond bits and core barrels.

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH 2nd WEST **SALT LAKE CITY, UTAH**

Idaho *(Continued)*

and its development completed by September.

U. & I. Uranium Inc. of Kellogg has merged its Hot Rock and Radon properties in the Big Indian District of San Juan County, Utah, into Federal Uranium Corp. of Nevada on the basis of one share of Federal for each 12½ shares of U. & I. stock outstanding.

U. & I. will receive 640,000 Federal shares for its 8-million shares issued. It is the operating company for six Kellogg mining companies—Caledonia Silver-Lead, Coeur d'Alene Silver Giant, Nancy Lee Mines, New Era Mines, Signal Mining Co. and Silver Bowl—each of which has 1-million shares of U. & I. stock.

Other U. & I. property assets, including the Rocket group in Grand County, Utah, and other holdings in the White Canyon area, have been retained for the shareholders and will be explored and developed through another corporation organized for that purpose.

Hecla Mining Co., meanwhile, is progressing rapidly with the job of opening up the big orebody under the Radon claims under a profit-sharing agreement concluded prior to the merger deal. Sinking of a 650-ft shaft to the ore zone was underway in May and it is estimated that the zone will be reached in August.

Bunker Hill & Sullivan Mining & Concentrating Co. is mining about 100 tons of development ore daily from the new 3110-level at its Crescent property in the silver belt of the Coeur d'Alene District between Wallace and Kellogg. Muck from the full drift rounds on the ore structure, believed to be the dowwnward extension of the Alhambra fault, which was the main producing structure on upper levels, is averaging about 20 oz silver per ton. Ore zone ranges from 4 to 5 ft wide and averages about 30 oz.

Bunker Hill's Crescent development is being done under a $1,098,750 DMEA contract, the biggest contract ever approved by the agency. It involved deepening the Crescent shaft from the 1200-ft level to the new deep horizon.

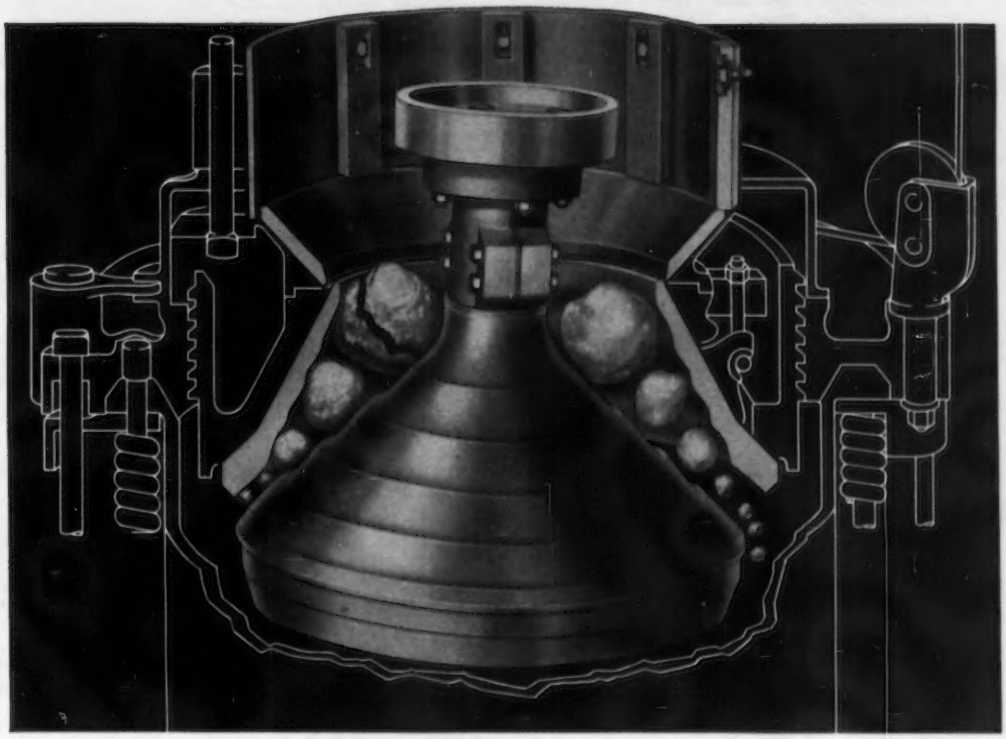
American Smelting and Refining Co.'s 3400 level development at the Vulcan-Galena mine on Lake Gulch west of Wallace has opened ore fully up to expectations in both width and grade in the main silver vein. Vein is opened to 200 ft by drift.

Mine, which was put on a production basis the first of this year after 8 years of development, is now yielding about 350 tpd ore, keeping the mill operating at capacity. First quarter output totaled approximately 22,000 dry tons.

AS&R operates the property under a long-term lease with Vulcan Silver-Lead Corp. Day Mines Inc. has a 25% interest in the lease.

Idaho Goldfields Inc. is installing a small, 15-ton mill at its Fourth of July Canyon property between Kellogg and Coeur d'Alene to process oxidized ore from surface operations on the vein opened

AMSCO® CRUSHER PARTS "give" a little to TAKE MORE PUNISHMENT



Amsco crusher parts are made of the toughest steel known—manganese steel. Typical of the Amsco line are the mantle and bowl liner in this sketch of a Symons® Cone Crusher. Symons is a registered trademark of Nordberg Manufacturing Company.

Under the violent crushing forces of impact, abrasion and pressure, the surface of Amsco manganese steel crusher parts work-hardens to as high as 500 Brinell. Yet beneath the working surface, the metal remains strong and ductile . . . able to *give* slightly under crushing forces . . . developing hardness as a new working surface is exposed by wear. That's why manganese steel crusher parts last so long, enduring severe abuse and resisting cracking or chipping even when worn thin.

Amsco makes manganese steel crusher parts for most manufacturers of crushing, grinding and pulverizing equipment. Buy your replacement parts from your crusher manufacturer to be sure of getting Amsco manganese steel.

Amsco also produces other alloy steels with maximum wear resistance under particular service conditions.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

Idaho *(Continued)*

near the portal of the adit tunnel. Mill will have a special type of grinding equipment to prevent "sliming" of the ore.

Silver Buckle Mining Co., Fortune Mining Co. and Eastern Lead Corp., all of Wallace, have joined forces with Pathfinder Uranium of Salt Lake City on an extensive uranium exploration venture in the Panhandle of Northern Idaho just east of the Washington area which has been the site of several uranium discoveries during the past few months.

Under the joint-venture agreement each company contributed 14 sections of state minerals leases, totaling 35,000 acres in all, to the project, and each will share equally in any ore discovery made on any of the sections.

Airborne scintillation equipment will be used for the initial exploration to pinpoint the most promising spots for surface work. Program will be directed by Pathfinder's consulting geologist, Paul deVergie, former AEC employee.

Sunshine Mining Co. has resumed deep-level development of the Yankee Girl vein in the property of Metropolitan Mines Corp., which it operates under a profit-sharing agreement. West drift, started several years ago, is now being extended to get under the ore zone opened on upper level in the western part of Metropolitan ground and beyond its boundaries in the area shared by Sunshine and Sunshine Consolidated Inc.

Meanwhile, the Metropolitan firm is pushing ahead with its program of bringing back into production the old Black Bear lead-zinc mine in the Burke Canyon northeast of Wallace.

Idaho's first shipment of uranium ore was made late in April; an 11-ton test truckload from the Donna Lou property in Lemhi County, shipped to Vitro Chemical Co.'s processing plant at Salt Lake City by G. & G. Mining Co. of Cortez, Colo., which is operating the property under a lease.

The 22-claim Donna Lou group covers the discovery made last February by Charles McConnell in a cut along U. S. highway 93 south of Salmon.

It was this discovery which touched off a claim-staking boom which has spread throughout the entire state. More than 2,000 claims have been located in the "primitive area" of the Salmon river valley and the state land board has leased over 150,000 acres since early April. Asotin County reported its first mineral location in 14 years.

Hecla Mining Co. has commenced preparations for sinking a 2080-ft shaft on the Silver Mountain Lead Mines' property east of Mullan, which it is exploring and developing jointly with Bunker Hill & Sullivan Mining & Concentrating Co. under a profit-sharing agreement with the aid of a $1,058,370 DMEA contract.

Shaft site, on Daisy Gulch just north of the old Snowstorm mill foundation, has been selected and is now being prepared for construction of surface facilities. Facilities will be completed about the same time the company finishes the shaft it is sinking on the Radon property in San Juan county, Utah, so that the same equipment can be used for both jobs.

Rare Metals Corp., a subsidiary of El Paso Natural Gas Co., has leased the old Idaho Almaden mercury property in Washington county and is planning to build near Weiser a 175 tpd refining plant with the largest single rotary kiln mercury recovery unit in the world.

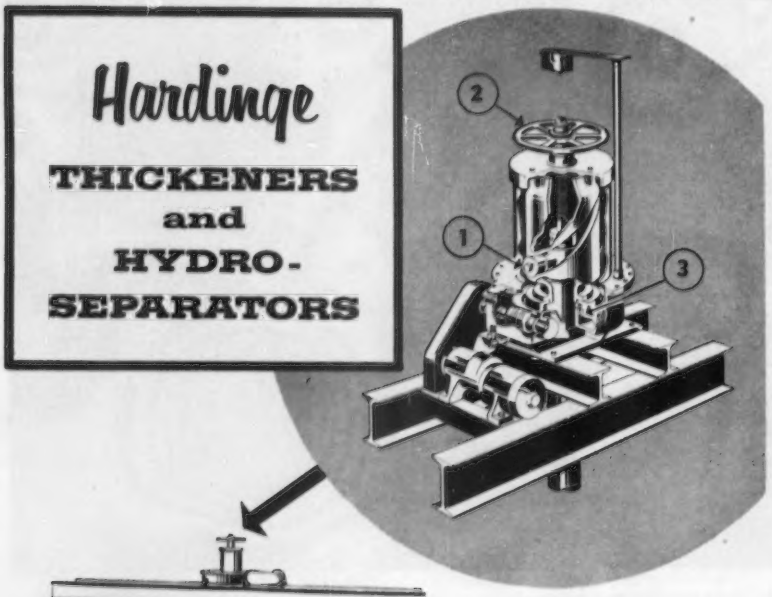
MICHIGAN

First ore was hoisted through M. A. Hanna Co.'s new Cannon mine shaft in March. Mine is located east of Stambaugh. Sinking of the shaft began Aug. 22, 1951. It required 43 months to complete 1,708 ft of shaft sinking. There were but two lost-time accidents. Ore is now being hoisted from the 7 level at a depth of 1,000 ft below shaft collar. Two 250 cu ft skips are used which, during the stockpile season, transfer the ore to 8-ton Dumptor trucks.

Globe Iron Co. of Jackson, Ohio, which

Hardinge

THICKENERS and HYDRO-SEPARATORS



. . . for all clarifying, thickening and de-sliming operations.

For flotation concentrates thickening ahead of filtering—or for tailings disposal or reclamation, Hardinge Thickeners provide:

1. "Auto-Raise" to avoid lost production from overloads.
2. Manual or power raise to supplement "Auto-Raise."
3. Replaceable ring-type ball bearing support for rotating mechanism.
4. Spiral rakes for maximum underflow density.

Also available are froth rakes for froth-free overflow and superposed type tank construction for minimum floor space and building economy. Complete specifications on request. Bulletin 31-D-1.

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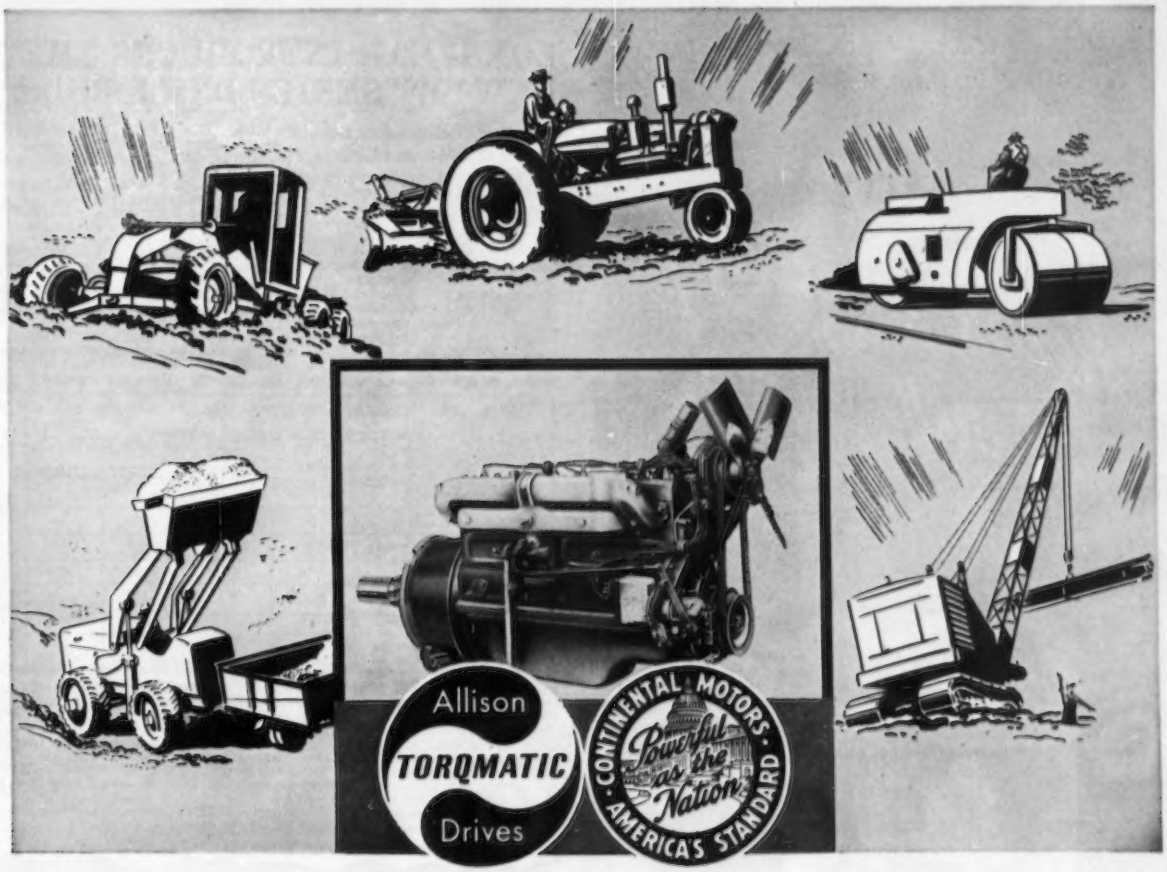

This Team

gets more work from less horsepower

YOU CAN GET an Allison TORQMATIC Converter matched to a Continental RED SEAL gasoline engine in a wide range of hard-working equipment.

When you do you'll get shock-free power that cuts costs all along the driveline—that keeps your equipment on the job building profits, not in the shop raising costs.

The TORQMATIC-RED SEAL team helps manufacturers reduce horsepower with no loss in equipment work-ratings. That's because the TORQMATIC Converter can *triple* engine torque—helps a lower-horsepower engine deliver higher *working* power.

And it automatically balances engine output with load demand to boost working speed and engine efficiency—increases engine life and cuts maintenance costs by keeping the engine in its most efficient operating range at all times.

Allison's newest TORQMATIC Converter is easy to install and maintain. It is completely self-contained, requires no complicated piping or other connections. It has a built-in pump and oil cooler, carries its own oil supply, has a simple dip-stick to check oil level.

You can get an Allison TORQMATIC Converter matched to gasoline or Diesel engines from 40 to 400 horsepower—a TORQMATIC Transmission for engines up to 300 horsepower. Ask your equipment dealer or manufacturer about Allison TORQMATIC DRIVES next time you buy—or write Allison Division of General Motors, Box 894M, Indianapolis 6, Indiana, for more details.

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TORQMATIC DRIVES

Longyear

New additions to our line!

Our new "24" Jeep mounted drill

The "44" truck mounted drill

LONGYEAR INTRODUCES THE NEW "W" SERIES DRILL RODS

New Sizes Accepted as Standard by DCDMA and CDDA

The E. J. Longyear Company recently announced a complete line of drill rods developed to the new standards adopted by the Diamond Core Drill Manufacturers Association and the Canadian Diamond Drilling Association. Known as the "W" series, these rods will come in EW, AW, BW, and NW sizes. These new standards have now been recommended for worldwide acceptance.

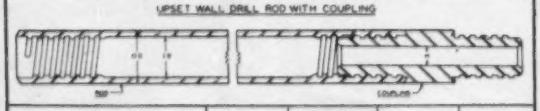
Field tests conducted by Longyear over a period of years indicate several distinct advantages to be provided by the "W" series rods. The over-all increase in size makes for a more stabilized drill string with less vibration and a minimum of ground caving. The increased inner diameter of the rod provides a larger water passage through the drill string and reduces pressure loss. The increased outer diameter reduces the area between the drill string and the hole wall which permits a more rapid return of sludge.

All Longyear rods, including the new "W" series, are made of cold drawn seamless steel tubing under closely controlled metallurgical conditions, thus assuring a uniform size and wall thickness with more than adequate strength and fatigue resistance for durability and efficient performance under all types of drilling conditions.

Change-over to the "W" series is expected to be gradual. In the meantime, Longyear will also manufacture the old standard E, A, B, and N drill rods and will supply the necessary important substitutes.

The new "W" series rods in all sizes are now available for immediate delivery. Specifications of "W" drill rods and couplings can be obtained by writing to E. J. Longyear Company, Foshay Tower, Minneapolis 2, Minnesota, U.S.A.

UPSET WALL DRILL ROD WITH COUPLING



Size of Rod and Coupling		EW	AW	BW	NW
Specifications	O.D. of Rod & Cplg.	1-3/8"	1-3/4"	2-1/8"	2-5/8"
	I.D. of Rod	1-1/16"	1-7/16"	1-13/16"	2-5/16"
	H Hole in Coupling	7/16"	5/8"	3/4"	1-1/8"
	Threads per inch	3	3	3	3
	Approx. wt. of 10' rod w/coupling	25.0 lbs.	33.6 lbs.	43.1 lbs.	55.3 lbs.

We clipped this news story when the "W" series was announced

INTRA-OFFICE MEMORANDUM

Longyear

TO Gene Larson DATE June 3, 1955

FROM Mike Gleason PLACE New Mexico

SUBJECT Mobile Units

Save for scrapbook Ed.

Dear Gene --

Our new truck and Jeep mounted drills have really put the needed mobility into our contract operations! We can get a rig set up and operating in less than half the time usually needed!

By the way, we've had a lot of comment AND QUESTIONS on the mobile units. If you'll send us a supply of bulletins 24-JU and 44-TU, we'll pass them out.

Thanks,

P. S. Right now, we're telling interested parties to write direct to Longyear in Minneapolis.

E. J. Longyear Co. FOSHAY TOWER, MINNEAPOLIS 2, MINN.

E. J. Longyear Co. MINNEAPOLIS, MINNESOTA

CANADIAN LONGYEAR LTD., NORTH BAY, ONTARIO • LONGYEAR ET CIE., PARIS, FRANCE

Minnesota *(Continued)*

begin on July 1 a 12-month-long study Schley has produced a total of 3,592,-

Michigan *(Continued)*

owns the Globe mine at Iron Mountain, has appointed Pickands Mather & Co. exclusive sales agent. Globe mine produced 36,420 tons in 1954. In 1950 it shipped 52,235 tons.

Pickands Mather & Co. mines, after having been on a four days per week schedule for the past year, resumed a five day week April 25. 275 men employed at the Buck group, including the Buck, Berkshire, Fogarty and Zimmerman mines in Caspian and Gaastra were affected. Spies mine of the Cleveland Cliffs Iron Co. in Mineral Hills resumed a five day week on April 18.

Meeting of the Lake Superior Mines Safety Council was held in Old Caspian on April 7. Robert P. Matson of the M. A. Hanna Co. was chairman of the program committee assisted by Thomas C. Hecker, M. A. Hanna Co. engineer. Papers were given on "Safety on Scraping Subs," "Falling Ground" and "Unsafe Practice and the Foreman."

MINNESOTA

Danube mine of Pickands Mather & Co. began treating crude ore at its new heavy-media plant, May 2.

31st annual conference of the Lake Superior Mines Safety Council was held in Duluth May 19 and 20. Among papers given were: "The Foreman's Responsibility in Safety," E. C. Woodward, safety director, A. O. Smith Corp., Milwaukee; "How to Teach the Safety You Know," Dr. Arthur Secord, Great Neck, N. Y.; "Building Safety Into Plants," W. F. Richards, Western Knapp Engineering Co., Hibbing; "Conveyor Belt Safety," W. A. Hyde, assistant superintendent of maintenance, Oliver Iron Mining division's eastern Mesabi district, Virginia.

Effective March 31, 1955, E. W. Coons Co. and Pittsburgh Pacific Co. were merged into a single corporation, the E. W. Coons Co., with offices in Hibbing. Officers of the new company are: W. C. Cohoe, president; W. E. Wilson, executive vice president; Hugh Harrison, vice president, mining; A. I. Foster, treasurer; E. T. Binger, secretary; V. J. D'Andrea, assistant treasurer. Harrison and Binger will continue as president and secretary of Pacific Isle Mining Co.

The company listed 8 mines among its various assets, including the Sidney, Genoa-Sparta, Union, Commodore, Victoria, Julia, Lincoln D. and lots 4 and 5 in Virginia City.

U. S. Steel Corp. has invested more than $23-million in two taconite plants at Virginia and Mt. Iron to find the best way to concentrate low grade taconite crude oil. This is but the precursor of many millions to follow, when the experimental plants have demonstrated that the processes being tested can produce a commercial product.

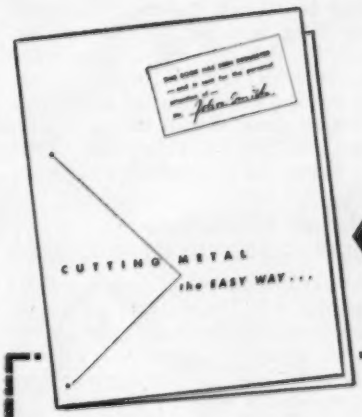
Paul Schroeder, president of the Schroeder

— with hand tools on the job or in the shop?

Porter hand power cutters cut up to and including

- 3/4" bolts — hard or soft
- 3/4" chain
- 5/8" rod
- 3/4" wire rope

as well as steel strapping, insulated cable, spring wire, etc.



SEND for this book which shows materials to be cut and cost comparisons between cutting methods. It may save you money.

H. K. PORTER, INC.
Somerville 43, Mass.

Please send me my copy of
"CUTTING METALS THE EASY WAY".

NAME _____

COMPANY _____

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CITY _____ STATE _____

MY DISTRIBUTOR IS _____

Minnesota *(Continued)*

Mining Co., McGregor, Iowa, has announced that stripping will begin at once on the Ernest Krueger farm, 6½ miles west of Chatfield, in northern Fillmore County.

Schroeder said the company expects to ship about 15 railroad cars of wash ore a day with first shipment by July 1. Ore probably will be shipped to Granite City, Ill.

Under a fellowship granted at the University of Minnesota by Reserve Mining Co., James Novotny, Los Angeles, will begin on July 1 a 12-month-long study of the texture, structure and minerology of the taconite deposits on the eastern Mesabi Range.

Jones & Laughlin's Pettit mine at Gilbert, converted to an open pit after having produced about 2½-million tons as an underground operation, will ship its first pit ore this season. It lies directly north of the company's Schley mine, also a former underground property. Both mines were idle in 1954; but both will produce in 1955. Schley and Pettit were opened up by Republic Steel Corp., which operated them until 1923. The Schley has produced a total of 3,592,850 tons of which Republic Steel mined 2,720,465 tons as underground ore and Jones & Laughlin took out 872,385 tons from open pit.

Cargo of 10,000 tons of iron ore has been brought from the Cerro Bolivar area in Venezuela to Oliver Iron Mining division's Extaca plant at Virginia for experimental work on nodulizing the ore.

Self-unloading steamer Calcite, operated by Michigan Limestone division of U. S. Steel Corp., opened Port Dolomite, newest raw material port on the Great Lakes, April 16, when it carried the first cargo of high grade dolomite limestone from the division's new Cedarville quarry in upper Michigan. Quarry is located near Cedarville, about 35 miles south of Sault Ste. Marie.

Limestone runs about 45% magnesium carbonate and 55% calcium carbonate. Dock at Port Dolomite is 620 ft long and 117 ft wide; it is on the edge of a natural deep water channel leading into Lake Huron.

MONTANA

Butte Copper & Zinc Co., for which the Anaconda Copper Mining Co. is operating the Emma Mine and other properties in the central portion of Butte, in its 1954 annual report states that it produced 237,858 wet tons of ore during 1954 as compared with 339,668 wet tons in 1953.

Sales of manganese nodules were sharply reduced, due to the recession in the steel industry and the dumping of foreign manganese on the U. S. market at low prices. Anaconda has entered into an agreement with the General Services Administration for the sale and delivery of nodulized manganese ore during the period ending June 30, 1955, of which approximately 44,000 tons will represent production from the Emma Mine.

Uranium has been discovered about three miles northeast of Winston, Broadwater County, east of Helena, in lake sediments in the form of carnotite, according to George E. Becraft of the Spokane regional office of the USGS. Similar

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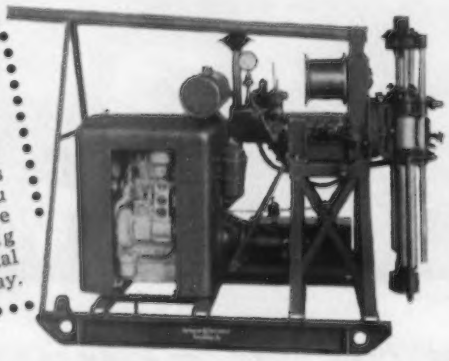

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Montana *(Continued)*

tertiary lake sediments are widespread in western Montana, Becraft said, and should be explored. A report containing a description of the lake sediments may be found in USGS Bulletin 972, entitled "Geology of the Canyon Ferry Quadrangle, Mont."

Formerly operated by Porter Bros. Corp., of Helena, and Spokane, Wash., to recover placer gold north of Helena, a large floating 6 cu ft Yuba bucket-line dredge is being dismantled by the Caird Engineering Works, and being shipped to Boise, Idaho. Dredge was operated electrically at its Helena location from 1935 to 1950 and treated about 5300 cu yd gravel per day, employing approximately 18 men. This was reportedly one of the only floating dredges in the world to use natural gas for heating purposes.

NEVADA

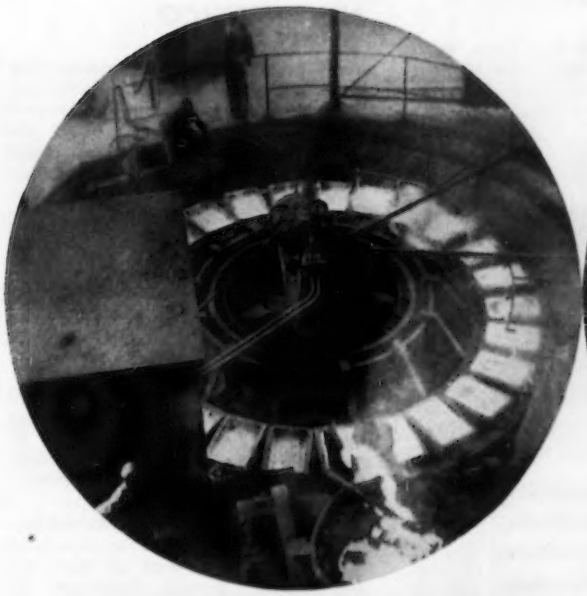
Nevada Ore Refining plant, south of Reno, was swept by fire early in April, the night before it was to have started its first regular processing of manganese ores. Mill had been under construction for many months, and extensive tests made. J. E. Martie, Reno, head of the company, said the final trial run was completed only a few hours before fire broke out. The structure housing the drying and sulphur rooms was destroyed; damage was estimated at $40,000. Martie says it will be rebuilt.

Leviathan sulphur mine in Alpine County was reopened during April by Anaconda Copper Co. Mine, situated high in the Sierra west of Minden-Gardnerville, supplies sulphur for treatment of copper ore at Anaconda's Weed Heights plant near Yerington. Mine was shut down late last fall because of bad weather.

Copper Canyon Mining Co.'s Lander County holdings have been taken over on a lease and option agreement by the Battle Mountain Copper Co., a newly-formed Utah organization. Reported option consideration is $1-million; arrangements for the transfer were made at a meeting of the Copper Canyon Co. stockholders in New York. New operators are revamping and enlarging the mill in Copper Canyon to handle 500 tpd which will be produced by open-pit mining. Ore from both the Copper Basin and Copper Canyon bodies will be mined, and treated by the leaching process at the mill. Copper Canyon operations were discontinued in October 1952 due to the decline in price.

First carload of uranium ore from the Bluebird Claim in Lincoln County brought a return of $2,500 from the Salt Lake City smelter during April, and production has been stepped up at the property as a result of better weather and road conditions. James G. Hulse and Philip Hulse, of Pioche, and L. L. Hezzlewood, of Las Vegas, are owners of the mine, situated 50 miles northeast of Pioche.

Here's a close-up of efficiency at O'Okiep Copper



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Nevada *(Continued)*

Magnet Cove Barium Co., Houston, Texas, has purchased 23 acres just west of Battle Mountain as the site of a proposed barium processing plant. Pete Edgar, resident manager for the company, says Magnet Cove has also taken option to purchase the cinnabar property on Lynn Creek in Eureka County owned by Carl and Lloyd Hannaman, T. G. and J. M. Edgar, and Marvin Syms. Exploration drilling has been started.

Vernon Pick, Grand Junction uranium millionaire, has launched an exploration program at the Ivanhoe district near Battle Mountain for mercury ores.

Pick, head of Pick Uranium Co. and Pick Mining & Electronic Enterprises, has obtained lease on three cinnabar properties: Silver Fox, Silver Cloud and Buttes properties.

NEW JERSEY

Warren Foundry & Pipe Corp. will reopen its iron mines "some time in June." Mines have been closed since January 1955, with current shipments from stockpiles. S. E. Shahmoon, president, told stockholders that production will near 400,000 tons per year, twice last year's figure, with the opening of two new small mines. Replying to questions on uranium at the New Jersey property, Shahmoon termed the rumor "daydreaming."

NEW MEXICO

Western Mines, Inc., is readying four integrated lead and zinc mines for production in the Cerrillos mining district. William E. Scorah, president of the parent company, Western Development Co., said the firm will also build a mill to produce lead and zinc concentrates.

Scorah also said Excalibur Uranium Corp., another subsidiary, is drilling on several claims in southeastern Utah.

United Western Minerals Co., Santa Fe, has acquired uranium leases covering 536,000 acres and an additional 48,000 acres in unproven oil and gas leases in a transaction involving $2¾-million.

Most of the property was acquired through merger with U. S. Uranium Corp. and Pueblo-Southern Corp. of Santa Fe and Border Uranium Corp., Pueblo, Colo. In addition, leases were purchased from 30 individuals.

Of the newly-acquired holdings, 500,000 acres are in New Mexico, mainly in the Grants-Laguna area of McKinley and Valencia Counties. There also are beryllium-mica claims in Santa Fe County and manganese properties in Socorro County.

Included in the transaction are 36,000 acres of uranium-vanadium leases in Utah, including a producing mine in the Henry Mountains, plus oil and gas leases in Utah and New Mexico.

Five silver mines in Sierra County will be reopened following lease of the properties by a syndicate of Albuquerque business men headed by C. M. Soto Jr. and V. M. Blum.

Mines scheduled for reactivation are the Keystone, Templar, Equator, Virginia and Comstock.

Initial plans call for concentrating some 100,000 tons of low grade ore that was dumped during earlier operation of the mines. The properties have been worked only for brief periods since 1912.

Lease agreement calls for a flat rental plus 10% of silver delivered to the U. S. Mint.

NORTH CAROLINA

Sen. John Kerr Jr., Warren County, has introduced a bill in the state legislature to provide depletion allowances for mining interests. Tungsten, under the bill, would receive an annual 23% allowance, as would bismuth, cadmium, cobalt, columbium, lead, lithium, mercury, nickel, platinum, tantalum, thorium, tin, titanium, vanadium and zinc.

Ka-Mi-Tin Co. of Lincolnton has leased

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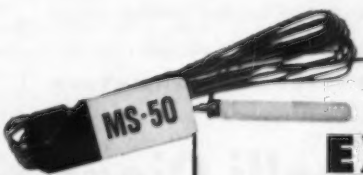
4. MINER connects "MS" Delays. Caps in each row are connected in series; rows are connected in parallel. Caps are fired with 250-volt DC power. Delay intervals used were MS-50 to MS-350.

5. A SURVEY of the room after shot demonstrates superior fragmentation produced by "MS" Delays. Good-sized, uniform breakage makes loading easier . . . more economical.

6. EFFICIENCY of the Du Pont blasting "team" shot is observable with room half cleaned up. There are no "bootlegs"—the shot has pulled all the way to the back of the undercut.

If you would like to improve fragmentation and increase efficiency in your mine, try Du Pont "MS" Delay Electric Blasting Caps. You can get more complete information from any Du Pont representative or by writing E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.

*"MS" Delays with copper or iron wires are available in following delay periods: MS-25, -50, -75, -100, -125, -150, -175, -200, -250, -300, -350, -400, -450, -500, -600, -700, -800, -900, -1000



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North Carolina *(Continued)*

its tin mine properties to Bostic Atomics, Inc., New York, which will conduct exploratory work on the approximately 650 acres in search of spodumene.

Preliminary explorations and tests, are reported to indicate spodumene deposits in the area, which in years past was the scene of extensive explorations for tin deposits. In recent years, however, the mines have been idle. J. N. Brenizer of Lincolnton is president of Ka-Mi-Tin.

OREGON

Progress report on the investigations of bauxite deposits in the Salem hills of western Oregon's Willamette Valley has been updated by F. W. Libbey, formerly director of the Oregon Department of Geology and Mineral Industries, and R. E. Corcoran, a department geologist, in a continuation of the studies first reported in September 1954.

The ferruginous bauxite is developed on Miocene basalts, which in later uplift and erosion results in a patchwork distribution. Ores occur as topographic highs separated by stream channels. Area lies about 7 miles south of Salem, state capital, in Marion County, and the deposits are located in a strip 3 x 6 miles.

Assays indicated a weighted average of 35.40% Al_2O_3 and 6.67% SiO_2 and 30.60% Fe_2O_3 and 6.56% TiO_2 on the drill cores sampled.

Portland dock commission has installed a second electric gantry crane at its Willamette River Terminal No. 1 to increase ore handling from ocean vessels to bunkers or railroad cars. Installation will boost discharge capacity to 200 tons an hour.

U. S. Bureau of Mines electro-metallurgical laboratory at Albany has ceased production of high purity zirconium for the Atomic Energy Commission and Carborundum Metals Co., Akron, O., will hereafter supply the rare metal.

Commercial production at the U. S. laboratory was started in 1949. Total production reached 1,250,000 pounds under the process developed by Dr. Wilhelm Kroll. Until recently the bureau was the only U. S. source. Initially the plant extracted the metal from black sands from the Oregon coast's Coos Bay sector.

Stephen M. Shelton, regional director of the U. S. Bureau of Mines and director of the lab, reported the agency will continue to experiment with zirconium to develop new uses in other fields. He reported it is used as a structural material in atomic reactors because of its relative transparency to thermoneutrons and its resistance to corrosion in hot water.

PENNSYLVANIA

Vitro Rare Metals Co. plans a plant-wide modernization and expansion pro-

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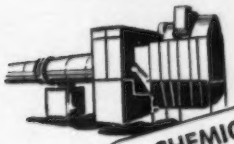

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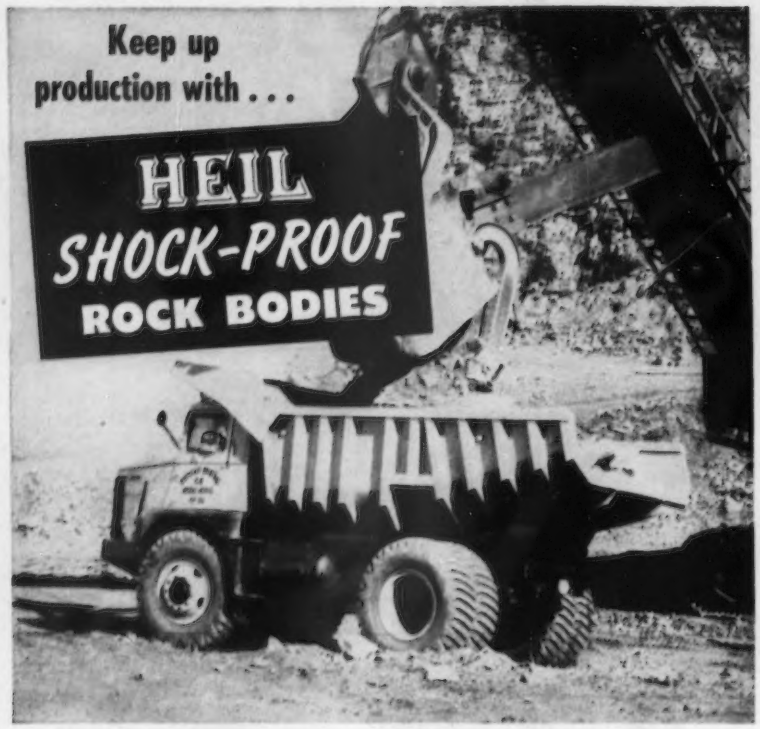

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BH-52-C

Pennsylvania *(Continued)*

gram to exceed $200,000 during 1955, according to Joseph J. Swigart, general manager.

Vitro Rare Metals refines and recovers rare metals and processes uranium-bearing residue materials for AEC. Canonsburg, Pa., plant, built for the Standard Chemical Company in 1909, was originally the country's largest producer of radium.

Mangaslag Inc., a pilot plant at Duryea, has ceased operations after unsuccessful experiments to remove manganese from steel slag. Operation was partly financed by Government moneys. Future operation now depends upon studies by a firm of consulting engineers.

Construction of Columbia-Southern Chemical Corp.'s titanium tetrachloride plant at Natrium, W. Va., is under way, company officials said in Pittsburgh. Catalytic Construction Co., Philadelphia, holds the contract for the plant, which is expected to reach partial production by April 1956. (See *E&MJ*, May 1955, p 73.)

SOUTH DAKOTA

Mining and shipping are now getting underway from Sodak Uranium and Mining Co. Inc.'s Dennis lease, in Wyoming, and the company's Joe Smith group in the Black Hills. Sodak also expects to be shipping from the newly-acquired Phillips orebody in Fall River County.

Company also holds an option on 21 claims in the Lignite area of Custer National Forest.

TENNESSEE

Preliminary data indicate that the production of gold, silver, lead, zinc and iron ore in Tennessee declined, while the production of copper, pyrite, and manganese ore increased with reference to 1953. Estimated total value of metals and ores (exclusive of pyrite) was $12,966,000, a decrease of $734,000 or 5% below 1953.

Average prices, preliminary for 1954, used in calculating the values of the metals and ores were $35 per oz for gold, $0.90505 for silver, $0.297 per lb for copper, $0.136 for lead, $0.111 for zinc, $6.40 per long ton for iron ore, and $86.00 per long ton for manganese ore.

GOLD AND SILVER: All recovered from copper-zinc ores mined by the Tennessee Copper Co. at Copperhill. Gold production declined 25% and silver 11% below 1953.

COPPER: Tennessee Copper Co. operated the Boyd, Eureka, Calloway and Mary mines. Total copper production increased 15% and total value increased 19% above 1953.

LEAD: A small quantity of lead was recovered from the smelting of zinc ores.

ZINC: Zinc production continued the general decline which started in 1953. Total production declined 21% and total

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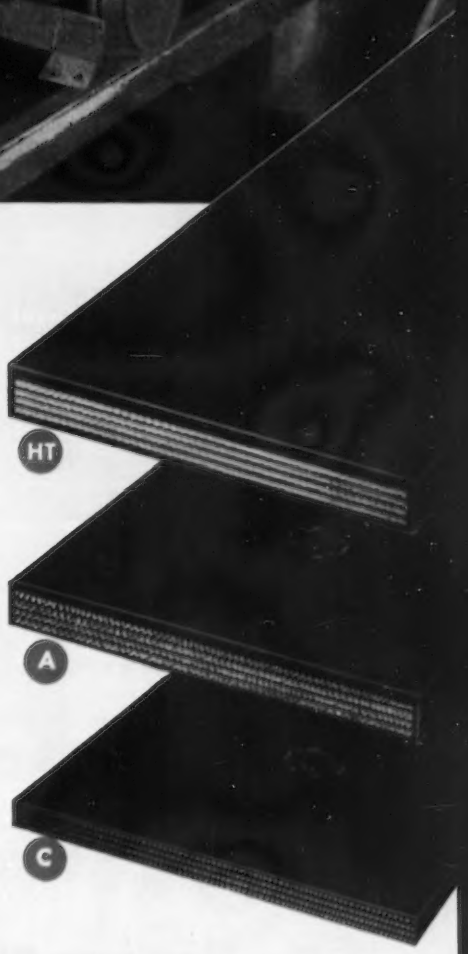

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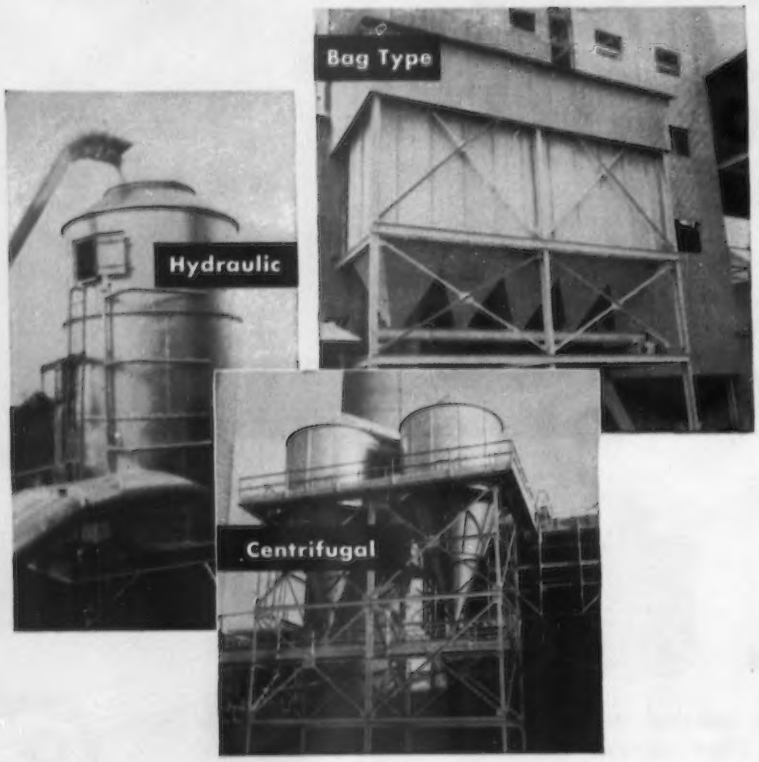

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Tennessee *(Continued)*

value declined 24% below 1953. American Zinc Co. of Tennessee operated the Mascot No. 2 mine in Knox County and the Grasselli and North Friends Station mines in Jefferson County. Tennessee Coal and Iron division, U. S. Steel Corp., operated the Davis-Bible mine in Jefferson County. Recovery of zinc concentrates was continued by Tennessee Copper in Polk County. New Jersey Zinc Co. continued development of its new mine near Jefferson City.

IRON ORE: Monroe Mining Co. operated the Lindermann mine in Monroe County and produced brown iron ore. A new mine was opened in red iron ore by Rockwood Mining Industry near Kingston. All the iron ore mined in Tennessee was consumed locally at the Rockwood plant of the Tennessee Products and Chemical Corp. Production of iron ore decreased 53% in quantity and value.

MANGANESE ORE: Valley Mining Co., Ltd., (McQueen, Scott and King mines), Ore Processing Corp. of Virginia (Brettler mine) and the Colitz Mining Co. produced manganese ore in Johnson County. Tennessee Manganese Co. and Lewis Mining Co. produced manganese ore in Unicoi County. Small quantities of manganese ore were mined by various small producers in Johnson and Monroe Counties. All ore produced in the state was of metallurgical grade, and was sold to GSA. Under the stimulus of Government stockpiling the production of manganese ore increased to nearly four times that of 1953.

PYRITE: Pyrite was recovered by Tennessee Copper from the concentration of copper-zinc ores mined in Polk County. Preliminary data indicate that pyrite production increased 5% over 1953.

UTAH

Bear Creek Mining Co., domestic exploration subsidiary of Kennecott Copper Corp., is in negotiations with E. J. Longyear Co. to take over the Jenny Lind Unit in the Tintic district.

The unit, unique in mining, covers 3,000 acres of unprospected but potential lead-zinc copper ground.

Participants are United States Smelting Refining & Mining Co., Chief Consolidated Mining Co., Newmont Mining Co. and the Raddatz Estate of Salt Lake City.

James Boyd, Bear Creek president and KCC's director of exploration, says that details of the geological program will be announced when contracts are signed with Longyear.

Jenny Lind Unit, near Jenny Lind Canyon, is so organized that if an ore find is made on one property, all participants to the unit receive a portion of the profits. The unit has been a number of years in forming. Chief Consolidated has 50% of the acreage in the unit.

Tintic district has been scene in recent years of the search by USGS official T. S. Lovering, who seeks to confirm surface indications in rhyolitic matters by core drilling.

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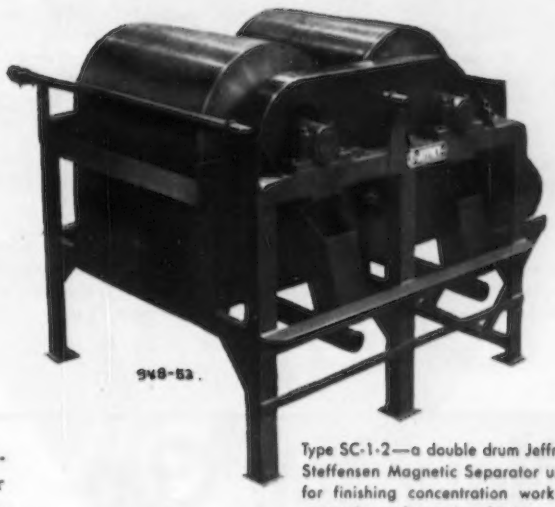

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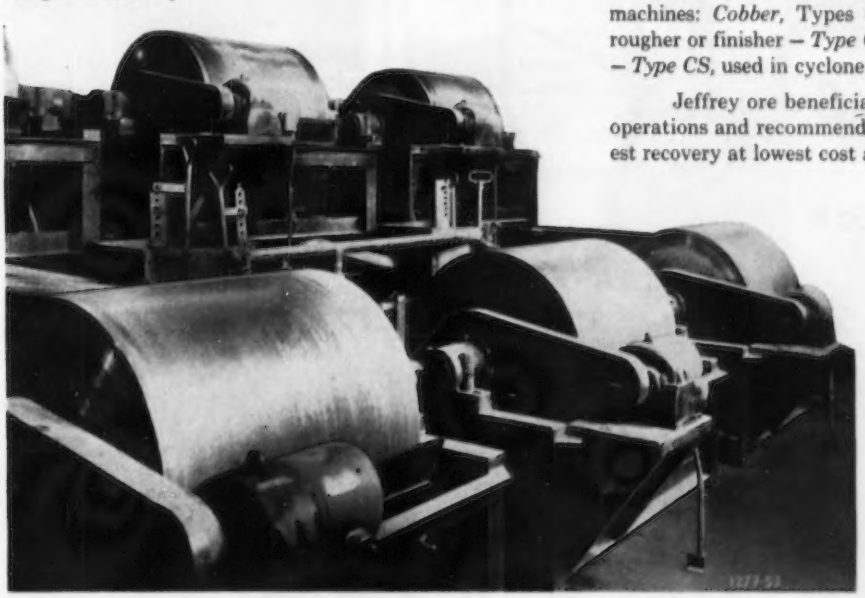

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Utah *(Continued)*

Standard Mining Co., subsidiary of Standard Ore & Alloys Corp. will mill uranium ores if present properties prove their indicated worth, Howard Steven Strouth, New York, president says.

Standard Ore & Alloys has been appointed U. S. licensee for uranium leaching and precipitation processes controlled by Canadian Patents and Development, Ltd., a Canadian Crown corporation.

Processes involved include leaching, precipitation of uranium from alkali metal carbonate solutions, and leaching of uranium from sulphidic materials.

Federal Uranium Corp., the Nevada-chartered concern, was firmly launched late in April after a last-minute hitch in merger of U. and I. Uranium Corp. did not materialize.

Firm, with estimated monthly production of 1,500 tons of uranium ore, 44,000 mining claims in Canada and United States, was formed under the guidance of financier Floyd B. Odlum.

Briant G. Badger of Salt Lake City, president of Lucky Strike Uranium Corp., announced his company had bought the Blue Lizard group, San Juan County, for $1-million. Lucky Strike paid $10,000 down, was to pay another $90,000 within 30 days, and raise $400,000 more through a public stock offering. The original owners agreed to take the remaining $500,000 in stocks, Badger said.

Uranium ore assaying at 9.8%—worth $1,525 per ton—came from the Yankee Girl mine in Red Canyon, San Juan County, during April, according to a report from the Plateau Uranium Co. of Blanding, owners of the Yankee Girl.

Plateau Uranium is a closed corporation headed by C. J. Baumgardner, president, and his brother, George O. Baumgardner, general superintendent of mining.

C. J. Baumgardner said the high-grade came from a vein about 800 ft long, 50 ft wide and from 6 to 8 ft thick. He estimated that ore already blocked out is worth $2.5-million.

William J. Owen (left), former geologist for a Texas oil firm, and Robert R. Norman (right) have formed Moab Mines, Inc., holding some 5,700 acres in southeastern Utah. Firm also has obtained a lease on an operating mine in the Uravan mineral belt in southwestern Colorado.

Vanadium Corp. of America disclosed uranium now is being mined at the 700-ft level of VCA's Prospector shaft near Marysvale.

Prospector is said to be the deepest uranium mine shaft in the U. S. yielding primary deposits of pitchblende.

Rocky Mountain Uranium Corp. reported production under way at two properties in May. Herman H. Lewis, general manager, said about 30 tpd was being shipped from the Rainy Day claims and 50 tpd from the Little Susan mine in Wayne County.

Continental Uranium, Inc., reportedly was to apply for an AEC contract to build a 200-tpd uranium ore processing plant near Moab in San Juan County, Utah.

License arrangements have been made on the Burwell process of treating uranium ores, developed at the Grand Junction plant of Uranium Processes.

Burwell process is owned by Blair Burwell, Raymond Sullivan, Minerals Engineering Co. and the Gidwitz interests of Chicago. Process anticipates oper-

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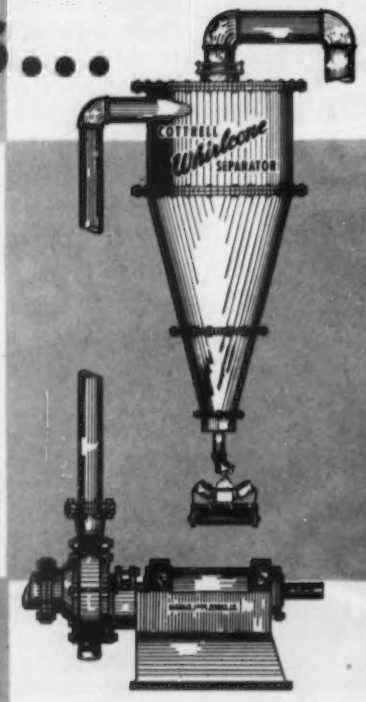

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Utah *(Continued)*

ating plants in the field close to the sources of ores at considerable economies over present installations.

Olympic Uranium Co. has developed a stope on the Brain fissure on Wasatch and West Toledo mines company ground at Alta running up to 40% lead; reports Olympic official Walter Jacobson.

Jacobson said several carloads of ore now in bins will be shipped to Midvale Smelter, United States Smelting Refining & Mining Co.

Ore, assays on which have been verified by Salt Lake Valley smelting companies, is said to run 6-7% zinc and 18 oz of silver to the ton. The stope at contact of the Alta over-thrust and the Brain fissure, is reportedly 50 ft long, 20 ft wide and five ft thick, Jacobson said.

VIRGINIA

Reynolds Metals Co. will construct a $3-million aluminum extrusion plant on its Bellwood property, 14 miles from Richmond, Va.

Construction will begin in early summer and plant is expected to be in operation by early 1956.

WASHINGTON

Daybreak Uranium Inc. has begun surface bulldozing at several drilling sites on the Alfred D. Dahl farm near Elk, in Spokane County. Firm plans to bulldoze a road through parts of the farm, and to make cuts for diamond drilling at sites specified by the AEC.

New firm, Morning Sun Uranium, is being organized by Spokane area men, to develop three 80-acre tracts of farmland east of the Dahl farm, operated by the Dahls under lease from the state. Logan Jorgens of Opportunity heads the new company.

Crews have begun bulldozer trenching of a radioactive area at the Germania Mine property in southwestern Stevens County. Operated by Tungsten Uranium Mines, Germania lies 5 miles north of the Midnight Mines property on the Spokane Indian reservation.

W. F. Dequase, Colorado geologist, has arrived in Spokane to direct the firm's development programs. Tungsten Uranium has obtained prospecting rights on a property in Lincoln County reported to show good radioactivity. The property consists of 680 acres west of Spokane Molybdenum Mines.

An 80-acre site on Lake Roosevelt will be explored as well. Pitchblende was reported found there about five years ago but the discovery was never confirmed.

The 1955 "Directory of Washington Mining Operations," prepared by Marshall T. Hunting for the State Division of Mines & Geology, lists 67 active metallic properties, an increase of 3 over 1954. Metallic minerals were valued at $15,105,960 in 1953, and accounted for 27.7% of the state's mineral production. In the same year production of industrial minerals was valued at $39,344,230.

Otto A. Case, Land Commissioner at Olympia, reported at the end of April that about 500 inquiries had been received in the last three months concerning prospecting the state-owned ocean tidelands for titanium. Approximately 2,000 inquiries had been received concerning uranium in the same period, Case said.

Operation of Chewelah Copper Co.'s properties 5 miles east of Chewelah changed management May 2. Earl B. Gibbs, Colville mining man and former operator of the old Bonanza Lead, will operate the properties on a profit sharing agreement to retire obligations the company developed when it acquired Bonanza Lead's mill at Palmer Siding. John DeGraff, formerly mine superintendent at the Bonanza, will be general mine superintendent. A power line will be built from Chewelah to the mine. Plans are for additional development work. Above the 400-ft level 400,000 tons of ore is available, according to Gibbs, who expects the company soon to be rated as one of the largest copper-

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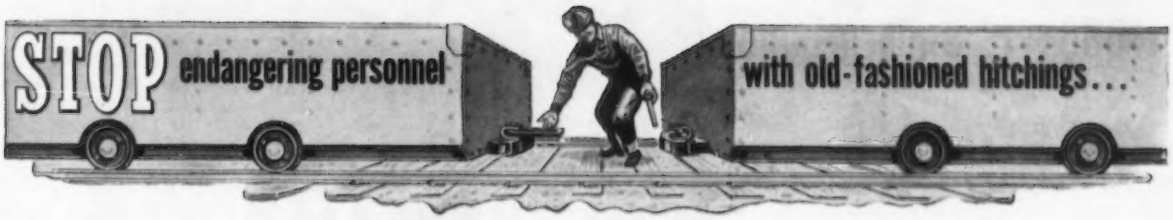

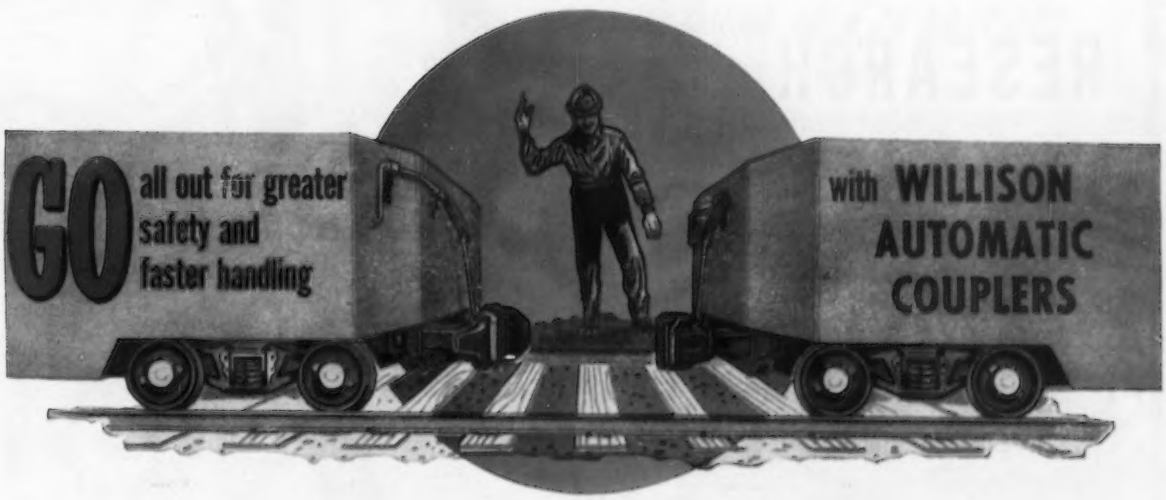

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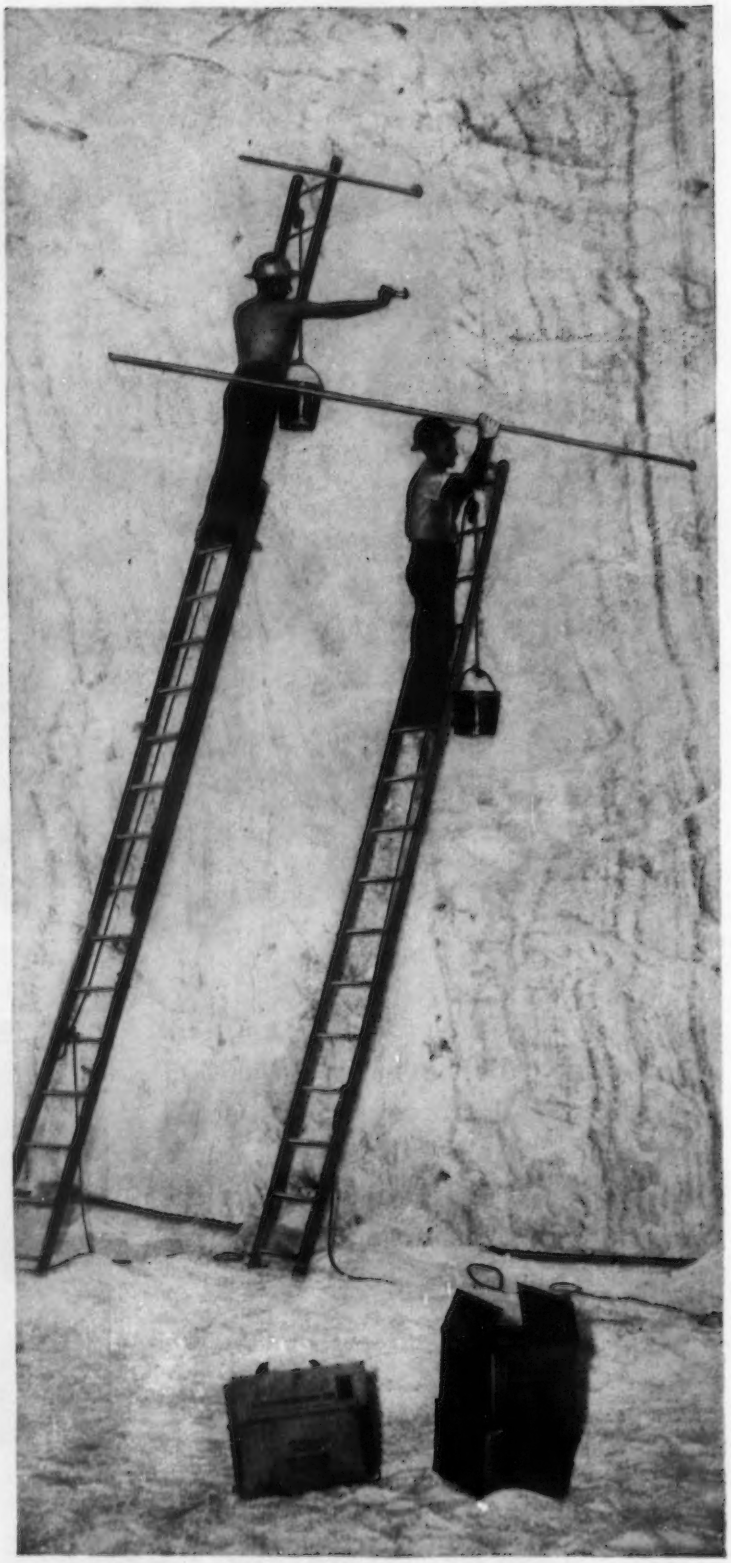

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AN59-6

Washington *(Continued)*

silver producers in the Northwest. Ore is to be trucked to the Bonanza mill north of Colville, but eventually a crusher, heavy media plant and milling machinery will be installed at Eagle Mountain.

Pend Oreille Mines & Metals Co.'s report for 1954 showed a net income of $303,-083, compared with $185,337 the previous year. Although known predominantly as a zinc producer, during 1954 more lead was produced than zinc. Total output of lead was 15,213,109 lb, compared with 13,484,689 lb zinc. Production cost per ton was reduced from $3.255 in 1953 to $3.054 in 1954, in spite of increased wages, salaries and cost of operating supplies, Stanly A. Easton, board chairman, and Lewis P. Larsen, president, reported. Production was at about 50% capacity. About 95% of ore mined was extracted by the trackless mining units installed. Drifts and raises totaled 827 ft. There was 508 ft incline shaft, 79,812 cu ft station work and 10,256 ft of diamond drilling. Third section of the incline shaft sinking was completed to 1218 ft from the 1600-level and the station was excavated for installing of crushing plant and electric control system. Raises have also been driven. When conveyor installation for the third section has been completed, total length of the 3 sections will be about 4,000 ft from the surface. Two 800-ton units were operated continuously in the East mill 6 days a week, the third being used as an alternate. There were short periods when all 3 were operated. West mill was not operated but the mine was operated 5 days a week.

WYOMING

Onega Corp., Uniontown, Pa., announces acquisition of 3,760 acres in potential uranium lands in Fremont County. Ore occurrence in the Wind River formation will be mined on an open pit basis, if drilling justifies.

First load of high grade uranium ore from the Sun Dog mine, in the Crooks Gap area of southeastern Fremont County, was delivered to the AEC ore-buying station in Riverton in early May.

Norman Harrower, one of the operators, estimated the 11-ton load would assay about 1%, making it worth about $1,800.

Harrower said both private and AEC geologists believe the Sun Dog may become one of the largest uranium producers in the county, and that the AEC plans to do extensive deep drilling on the claims.

Following the recent Pumpkin Buttes dispute, local prospectors formed the National Association of Prospectors, headed by Charles Ervin of Cheyenne, and called for public hearings to tell their side of the story. Interior Department called off the opening of the 65,000 acre uranium project in Johnson and Campbell Counties until the trespassing dispute can be ironed out without bloodshed.

IN CANADA

BRITISH COLUMBIA

Although most of the province has not been tested with counters, prospecting fever reached a new high last month. Claim filing, covering several thousand acres in the Slocan Valley, West Kootenay district, and in the area north of Burns Lake started the rush. Thomas Eliot, assistant manager at B. C. and Yukon Chamber of Mines, Vancouver, has received over 1,000 inquiries to date.

Companies prospecting in the area include: Noranda Exploration, Newmont Mining, American Smelting & Refining, Anaconda, Consolidated Mining & Smelting, Rio Tinto, Granby Consolidated Mining & Smelting.

Hottest is the Slocan Valley where 95 claims were filed in one week. Jackson Basin Mining Co. and several other companies are in this area. Eugene Hird, Slocan City is the only private prospec-

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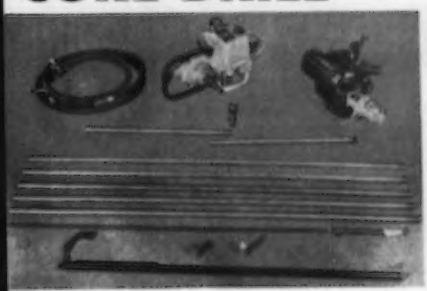

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British Columbia *(Continued)*

tor filing so far but others are expected to follow his example.

In the area 200 mi north of Burns Lake, John Stoneburg, former Washington, D. C. newspaper editor and Justin Pomeo, Hartford Conn, have flown into their claims and will stay there until the breakup. Majority of the claims in the area are being staked out (2,600 acres to date) by P. J. Carroll of Southbank.

More than a hundred claims (mostly held by Respar Uranium) have been filed in Birch Island area on North Thompson River near Kamloops in the past two years.

Significant recent discoveries have been made near Atlin and in Yoho National Park, while a large number of claims have been staked by Bethlehem Copper in the Keefer area.

Taiga Mines Ltd. of Vancouver will operate complete mining plant and transportable milling unit, capable of handling at least 200 tpd.

Company will make arrangements with property holders whose indicated ore reserves do not warrant construction of a large fixed plant. Taiga would step in with its portable mill and operate such mines for two-thirds of the net operating profit.

Spokane metallurgical engineer F. Stanley Huckaba designed the portable mill, to cost about $250,000.

Contract with a West German steel company to supply 100,000 tons of ore has given Texada Mines Ltd. a new lease on life.

The mining company, operating on Texada Island (35 miles upcoast from Vancouver in B. C.) was faced with shutdown because of lack of markets.

President Oswood G. MacDonald of Cowichan Copper Ltd. said $200,000 had been obtained through shipment of development ore for treatment to Tacoma smelter.

Mr. MacDonald said total length of ore development in the main orebody on 1200-ft bottom level to date was 600 ft. Average width over this length is 35 ft and the grade about 4.5% copper. A 100-ft length with average width of 45 ft exceeded 10% in grade.

End of an era was marked in British Columbia last month with closing of Vancouver office of Royal Canadian Mint after 54 years operation.

Branch manager Kenneth Clifford West said all assay furnaces, gold bar molds and other equipment are being sold since all Canadian gold will be handled at the mint at Ottawa from now on.

Silver Hill Mines Ltd. of Vancouver announced mid-summer production schedule for its operations on Treasure Mountain, central British Columbia.

Indicated ore reserve of at least 65,000 tons has gross value of about $3.5-million at present metal prices with no allowance for ore below the No. 2 level or in the Jensen adit, states R. L. Bothrup, president.

An operating rate of 50 to 60 tpd is

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British Columbia *(Continued)*

planned with power supplied by a new 250 hp diesel and 150 kw generator.

Plans are under way to bring Snowdrop Gold Mines into full production following discovery of high grade ore on the property near Cascade Highway near Rossland which gave operators net return of $1,787 on a shipment of 69 pounds.

Returns of the shipment, forwarded to Cominco smelter at Trail for treatment, showed gold content of 1628.595 oz to the ton while silver content was 239.45.

J. J. A. Crowhurst, manager of Granduc Mines Ltd., has informed shareholders that transportation of equipment, supplies and material for 1955 development program to copper property on Leduc glacier has been completed with total of 950 tons hauled.

1955 program was to start in May. It includes extending the 3250-ft level for 1,000 ft further into the hillside to provide additional information on the orebodies.

In addition, a second adit will be started 500 ft vertically above, at the 3750-ft level, and will be driven for 2,000 ft to search for vertical continuity.

Over-all objective of the work is to prove up additional tonnage to the substantial tonnages already outlined so production plans of the copper producer can be drawn up.

Total of 9.5-million (average copper content 1.5%) mineable ore reserves were shown in annual report.

ONTARIO

Ascot Metals Corp., Ltd., plans to resume work soon on Trio Uranium properties in the Parry Sound area, Ontario. Work will further develop the high-grade euxenite showing where trenching, in two samples to date, has given uranium 0.54% and 0.35%; thorium 4% and 2½%; columbium 6% and 4%; and tantalum 2% and 0.8%.

Ascot Metals has purchased the Duval 1,000-acre group, in the LaMotte lithium mining area of Quebec. Two known mineralized dikes are exposed on the Ascot group.

Coldstream Copper Mines, idle since 1952 on its property midway between Steep Rock Lake and Port Arthur, is planning renewed development. First step will be shaft deepening to 500 ft to explore the main zone at a second horizon. Work prior to closure suggested 800,000 tons to a depth of 800 ft averaging 3% copper, or 2-million tons averaging 2%. Company also plans surface drilling on a number of known anomalies, work to date having been limited to a small section of 40-claim group.

A second probable producer is shaping up in the Manitouwadge area (*E&MJ*, July 1954) as Willroy Mines considers plans for underground work. Company has been drilling its big property adjoining Geco Mines for more than a year now, and has outlined three copper-zinc-silver zones. Most work has been done on No.'s 1 and 3 zones, and for No. 1 the company estimates 796,000 tons averaging 1.5% copper, 0.46% zinc, and 0.47 oz silver, while unofficial studies of No. 2 suggest a like tonnage of slightly higher grade. Drilling is continuing.

Falconbridge Nickel Mines now has five mines in operation with three more under development, all in the Sudbury basin area. Production last year set a new record at 38.7-million lb nickel and 22.4-million lb copper. By late 1956, it is expected that capacity will be 55-million lb nickel annually. Despite increased output, reserves are highest in company history.

Merger of Croft Uranium Mines and Centre Lake Uranium Mines into Bicroft Uranium Mines has been announced in southeastern Ontario's Bancroft area. If anticipated purchase contract can be arranged with Ottawa, merged enterprise expects to have reserves to keep a 1000-ton mill running for 5 years.

At Blue Rock Cerium Mines, Bancroft area, a three-compartment shaft is being sunk to 500 ft to test showings on three levels.

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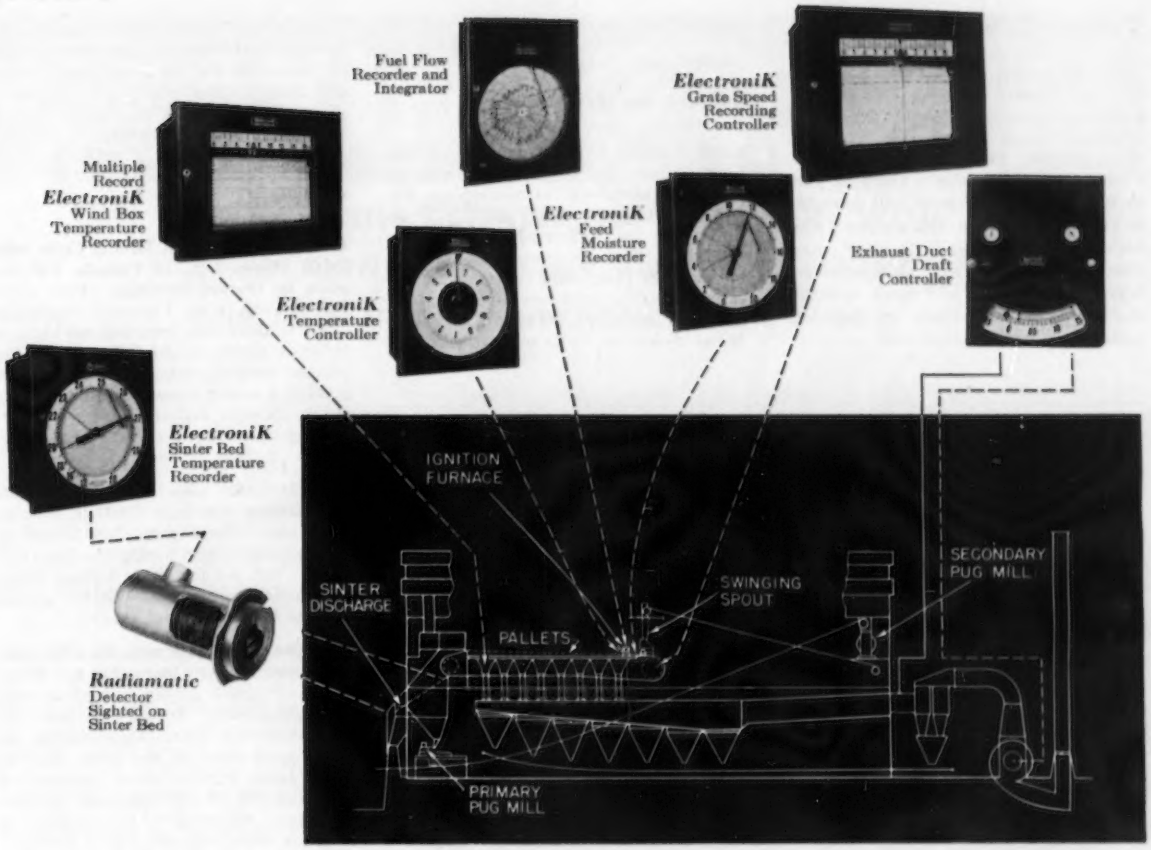

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● **REFERENCE DATA: Write for Composite Catalog No. 5002 for a condensed listing of all Brown instruments.**

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BROWN INSTRUMENTS

First in Controls

Ontario *(Continued)*

Plans for lateral exxploration are under way at Central Porcupine mines and Coniaurum mines, following completion of internal shaft sunk in Central Porcupine ground from the extension of Coniaurum's 5500 level. Opening goes to 6850 ft and first level will probably be established at 6800, and used as a base for extensive flat drilling to test Central Porcupine ground which, though in the heart of Porcupine's gold camp, failed to show ore of importance at shallower horizons. Both camps will share in profits from any ore located.

NEW BRUNSWICK

Good progress is being made by Heath Steele Mines, the subsidiary formed by American Metal Co. to develop the big zinc-silver-copper mine indicated by drilling in the Bathurst-Newcastle area last year. Two exploratory shafts will be sunk this year, while in the meantime surface drilling continues to add to the already indicated tonnage. American Metal holds a 75% interest, the remaining 25% having been received by International Nickel Company of Canada in return for the big geophysical survey job that sparked the exploration program. It is probable that initial milling rate will be 1,500 tons daily.

QUEBEC

International Lithium Mining Corp. with Dyno Mines, Ltd., of Canada, will explore its Quebec holdings. Four drills are working in the Figuery-LaMotte-LaCorne lithium area. International Lithium holdings cover almost 5,800 acres and enclose over 6 miles of the LaMotte granite, a source magna of lithia-bearing dykes. Several shallow dipping, lithium-bearing dykes have already been intersected.

East Malartic mines is increasing its daily milling rate from 1,500 to close to 1,800 tons, reflecting excellent results of depth development during the past two years. Ore on the three bottom levels is reported proving to be well above mine average in tonnage and grade.

New Oka columbium area, 30 miles west of Montreal, shows increasing activity as more companies acquire ground or start exploration work. Recent newcomers include Aumacho River Mines, drilling on 1,300 acres close to the town of Oka; Gulf Lead Mines, doing geophysical work on 14 claims adjoining Coulee-Headway, where drilling has been in progress since last fall; Conro Development Corp., with 600 acres slightly northeast of Gulf; and St. Lawrence River Mines, with a large group in the south section of the camp. Drilling on Molybdenum Corp. of America's property has reportedly indicated large ore tonnage. Moly Corp. is now studying metallurgy and marketing.

Quebec Lithium Corp., well on its way to production at its lithium mine in LaMotte and LaCorne twps., is investigating the possibilities of establishing its own chemical processing plant for production of lithium compounds and, possibly, the metal itself.

Present plans call only for output of concentrates, the project having had its start with a contract from Lithium Corp. for delivery of 165 tons of concentrates daily. Such an output calls for treatment of 800 tpd, but the mining and milling equipment have been designed to handle almost double that tonnage. Establishment of a chemical plant will follow, providing the economics can be worked out. In the meantime the shaft has reached its initial objective at 525 ft, and lateral work is being started on two levels.

LaMotte-LaCorne area has become a busy place as a result of Quebec Lithium's progress, and many other companies are now in the district. Two of these, Canadian Lithium Mines and Valor Mines, have reported good ore intersections in surface drilling. Among more recent arrivals on the scene are Tiara Mines with 800 acres, Consoli-

young man in a hurry!

He's keeping up with one of Fairchild's fast-flying airborne magnetometer planes to make *this morning's records available tonight* for our client's easy interpretation.

The original airborne magnetic records come out of the recorder on an "inches-per-minute" basis, which can never be made to equal inches-per-mile, especially when our airplane flies against the wind on one flight line, and with the wind on the next line. This makes alternate magnetic profile tapes of different lengths (as well as reversed), and the records have different horizontal scales. Because of this, critical measurements on individual magnetic anomalies are hard to make, and magnetic trends are sometimes hard to visualize.

With this variable speed plotter, which we call our "stacker," we redraw the profiles to any desired horizontal and vertical scales, and put them in their proper position, one above the other, for rapid and sound interpretation. One of the original magnetic records is on the small drum to the left, the sheet of stacked profiles on the large drum. Magnetic trends thus become immediately visible, and the anomalies can be carefully measured.

These "stacked profiles" aren't quite as precise or valuable as the final Fairchild magnetic contour map, but several of our clients demand them because of their quick availability and convenience—particularly when the client is in the field with our flight crew, and wants to be able to take immediate action on the magnetic results.

Our stacked profiles will beat the preliminary contour map by at least a month, maybe more on a big survey.

And so our young man's in a hurry.

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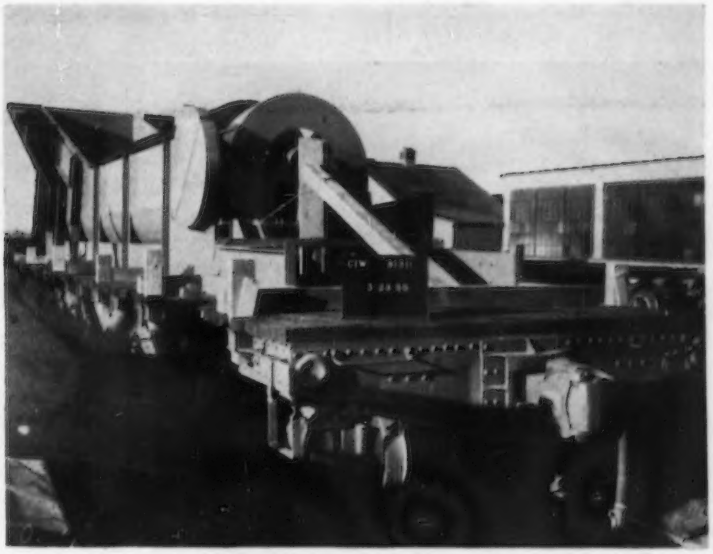

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Quebec *(Continued)*

dated Negus Mines with two groups and plans made for drilling on both of them; Ascot Metals Corp., with nine claims on which surface showings are reported in evidence; and New Laguerre Mines, with drilling started on an eight-claim holding.

Three-compartment shaft, depth 550 ft, is to be put down by Duvan Copper Co. on its property in Desmeloizes Twp. in the Normetal area. Present plans call for 2,000 ft of lateral work to be done on two levels. Diamond drilling has indicated a number of zones carrying encouraging copper values, and the main structure has been traced for a length of several thousand feet across the property.

NEWFOUNDLAND

"A large concentrating mill will be erected this year at Tilt Cove" and "other mines and mills are to follow soon afterwards" in the wake of the province's development plan, says Gregory Power, finance minister.

Minister Power said he will shortly ask the House of Assembly to authorize a $16-million loan to continue expansion. He also pointed out that British Newfoundland Corp., formed of British, Canadian and other corporations, is conducting a survey of the River Hamilton in Labrador. In that watershed, Mr. Power said, 4-million hp could be developed.

Major increase in Newfoundland's production of copper is in the offing. Two companies headed by M. J. Boylen (of Brunswick Mining & Smelting Corp. fame) have jointly taken over two long inactive copper properties of promising potential. The companies are Maritimes Mining Corp. and Bathurst Mining Corp., both formed to acquire ground in the Bathurst (N. B.) rush of 1953, and both still holding important groups of claims in that province. New properties acquired are the Tilt Cove mine, on the west side of Notre Dame Bay of Newfoundland's north coast, while the other is the Gull Pond property, some 50 miles to the south.

At Tilt Cove, a reserve of 2.2-million tons averaging 2.2% copper is reported in sight, and tonnage is being healthily increased by new work; a 2,000-ton operation is visualized, and plans are already being drafted for a 1,000 tpd mill. Plans call for the start of production by mid-1957. A start is being made at once on a 1,000-ft production shaft.

At Gull Pond, where a smaller deposit of about similar grade is being developed, a 500 to 1,000-ton operation is visualized. Shaft is planned for this property also.

SASKATCHEWAN

Gunnar Mines Ltd. expects uranium production of 1,250 tpd by the end of this year.

Announcement by the Alberta Northwest Chamber of Mines & Resources stated that officials were pleased with progress at the northern Saskatchewan mine, where production will be started by September.

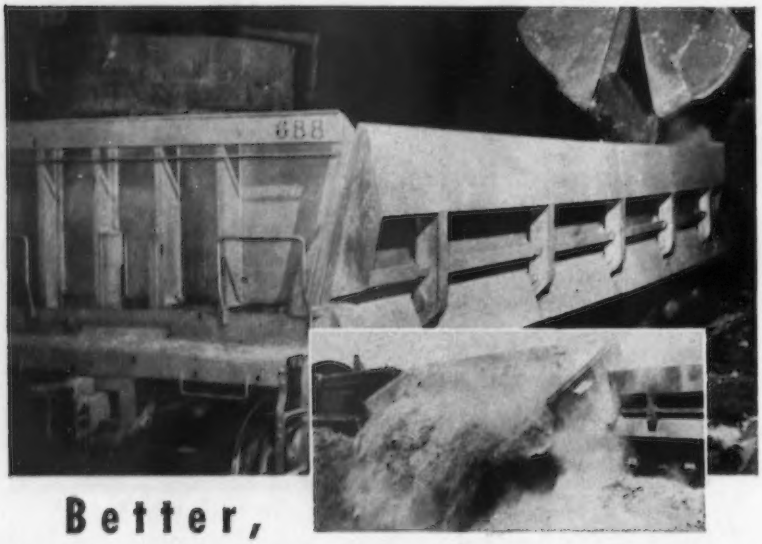
Shell Oil Co. of Canada will supply sulphur to the Gunnar mines for use in treating the uranium ore. It will be converted to sulfuric acid for acid leaching.

In the four months that the waterway will be open this summer, 8,100 tons of sulphur will reportedly be transported the 800 miles from Shell's plant at Jumping Pond, Alta., to Beaverlodge.

IN LATIN AMERICA

MEXICO

Sindicato Industrial de Trabajadores Mineros Metalurgicos y Similares de la



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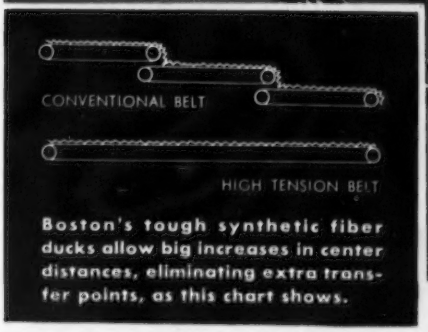

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Mexico *(Continued)*

Republica Mexicana now has signed with most major mining companies and peaceful negotiation is expected on the few contracts yet to be signed.

In general, miners received a 10% wage increase, more or less, plus major fringe benefits, aimed largely at keeping in check the continuing increase in cost of living which began after April 1954's peso devaluation.

Contracts just revised are valid for two years under normal schedules. It has worked out, however, that there have been five revisions in the past five years. For instance, in May 1954 miners were given a 12% wage increase to offset devaluation.

Cia. Minera Tisur, S.A., affiliate of Republic Steel Co. which has been charged with developing the rutile deposit in the State of Oaxaca, now estimates that production of titanium concentrates will get underway in mid-1956.

Production is to be built up through three units, each producing 2,000 metric tons of concentrate a month. Only the first unit is expected to begin output in mid-1956.

Depending on market demand, the remaining two units will be built and put into production. It is expected that all three units, producing 6,000 tons of titanium concentrate a month, will be in operation by the end of 1958 under projected plans. Neither Republic Steel nor its Mexican affiliate knows exactly at this time the extent or grade of the deposit. Proven estimate is 25-million tons on only 250 acres of the 6,000-acre concession.

In July Republic plans to move in compressors and other mining equipment over the 134-mile road from Oaxaca City. For the past few months, some 40 men have been building and improving local roads. Transportation probably will be the biggest cost item in the development of the property.

It is planned that mining will be conducted both through shrinkage stopping and through open pit benches. In some areas the ore is exposed; in others it is covered with as much as 50 ft of overburden.

Plant will contain jaw and gyratory crushers, and ball mills. Fresh water is plentiful and there is an adequate labor supply. It is estimated that fully 800 men will be employed in operation of the first unit. About 100 tons of the rutile arrived at Republic's Ore Dressing Dept. in mid-May for metallurgical tests to determine just what sizes and types of equipment will be needed.

Some 1,200 men are intensively mining quicksilver from cinnabar in two new districts in the State of Durango.

About 20 mines are busy in the Cuencame District in eastern Durango. In the El Curante District of northern Durango, about 40 mines are operating. All mines are small, employing 10-30 men. Only about half the mines have retort furnaces. Ore runs from 0.1% to 1.0%. The miners haul mercury to Torreon for export to the U. S.

One of the heavy-duty, go-anywhere, Portable Service Stations in use on the Orinoco project. Note variety of lubricants pumped, separate power supply, lights for around the clock operation.

Link-Belt Company Photo

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Yet, lubrication facilities at this remote iron ore source, under these difficult conditions, are as complete, in the protection they offer, as those at the finest service station or car dealer in Philadelphia. The answer is Alemite Portable Service Stations.

These portable units take lubrication where it is needed, right to machines and mining rigs. Pumps, hose reels, etc., are mounted directly on truck beds. The result is a complete, self-powered maintenance department ready to go anywhere. These three benefits are the immediate result:

1. Save Time! By bringing complete power lubrication to all equipment on the job—safely—efficiently.

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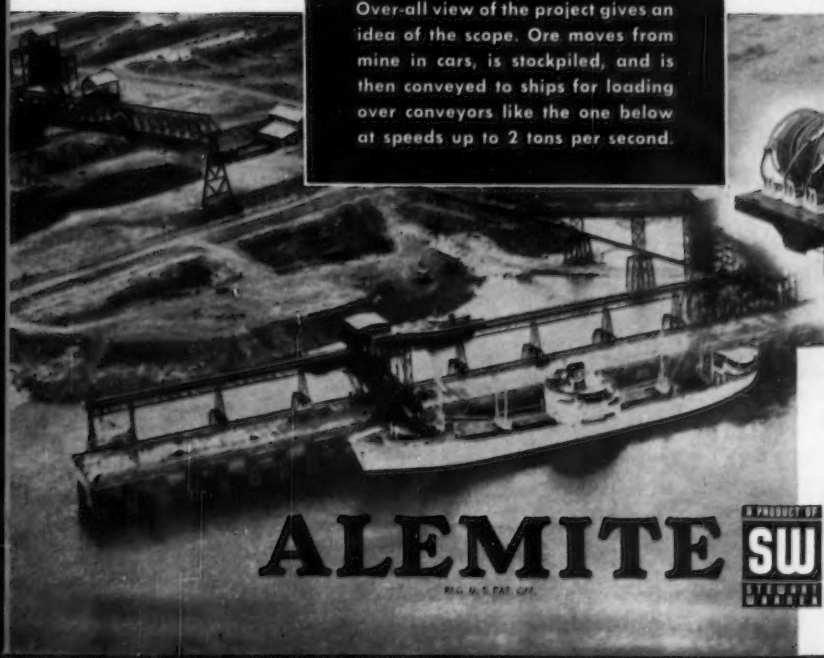
Over-all view of the project gives an idea of the scope. Ore moves from mine in cars, is stockpiled, and is then conveyed to ships for loading over conveyors like the one below at speeds up to 2 tons per second.



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Mexico (*Continued*)

Main Mexican mercury producing districts are Guadalcazar, San Luis Potosi; Huitzuco and Huahuastla, both in Guerrero; and Opal and Nuevo Mercurio, both in Zacatecas.

During 1954, production was 508,636 kg compared with 401,362 kg in 1953. All mercury produced was in metallic form. Exports in 1954, 18,464 flasks; against 12,483 during 1953.

Whereas practically all of the 1953 exports went to the United States, only about 62% was sent during last year, the remainder shipped to Europe and other Latin American countries.

During 1953, the United States purchased about 85% of the volume of minerals and metals Mexico exported during that year. However, in 1954, U. S. purchases fell to 76% of total volume.

Principal cause for this slight shift is ascribed to the notable increase of 1954 exports of lead and mercury to Europe. Mexico is endeavoring to widen its metals and minerals markets.

This effort at finding new markets stems partially from the scare Mexico had last year that U. S. tariffs might be raised against foreign lead and zinc.

ARGENTINA

Argentine National Mining Department (Dirección Nacional de Minas) has installed a modern chemical laboratory in the premises of its regional branch in the city of San Juan.

It has also started construction in the same region of a repair and service shop for the mining machinery and implements for operations in the so-called "Cuyo" area, the Provinces of San Juan, La Rioja and Catamarca.

Department is also studying plans for the installation of regional mineral concentration plants in strategic zones of Argentina. Plants, to be run by the Mining Department, will be equipped with modern machinery, mainly to help small miners, enabling them to process their mineral ores at low cost under state guarantee.

The first plant will be aimed at an increase in production of lead, tungsten, magnesium, gold and manganese in the Provinces of San Juan and Catamarca.

Department has undertaken a survey in the Province of Mendoza to determine the existence of copper reserves.

I. A. P. I.—the official Argentine import-export body, which exclusively markets the country's principal minerals and metals, during April (1955):

Purchased 196 metric tons of beryllium and 50 tons of tungsten; added 16 tons of mica to the rather large reserve it already holds of that mineral; and purchased 150 metric tons of lead ore from the small miners.

During the same period I. A. P. I. also exported to Chile, Sweden and Great Britain 153 tons of rafaelite, valued at US $10,000. Only other export made

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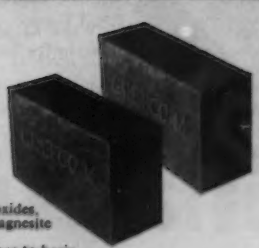

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Argentina *(Continued)*

was 36 tons of mica, valued at US $26,000, which went to Italy.

During April, I. A. P. I. called for bids for the supply from abroad of 3,000 tons of copper, 2,500 of zinc, 2,000 of aluminum, and 500 tons of tin.

No official information was available, but it is anticipated that the copper order would go to either Chile, Japan or Holland. U. S. firms were bidders on the aluminum, zinc and tin orders. In all four cases I. A. P. I. is direct buyer and importer-distributor.

Concentration plant was inaugurated in Jachal, Province of San Juan, in April, with domestically-made equipment and machinery, though claimed to be of the "Denver" type. Operated by Minarbipa, S.R.L., with a working capital of 500,000 pesos, concentration is by flotation and separation. Minerals concentrated are tungsten and lead. Plant has a production capacity of 20 tpd.

BRAZIL

A large deposit of bauxite has been discovered in the territory of Amapá, according to recent information. This territory borders with French Guiana, on the northern part of Brazil. Mineral found is considered of superior quality, excellent in the manufacture of aluminum, and with a mineral content of over 69%.

BOLIVIA

H. A. Brassert Co. Inc. will explore Bolivia's Mutun iron ore deposits on order of the national government. Mutun is in eastern Bolivia, near the Brazilian border.

Under contract, Brassert Co. will make geologic surveys and drill for iron and manganese, reporting their findings to the government. Brassert will receive a reported $48,000 for services, plus expenses for personnel to a maximum agreed sum.

CHILE

Administration has announced willingness to expend 450-million pesos for modernization of the Chagres smelter. Smelter is owned by du M'Zaita, is equipped with a reverberatory furnace built in 1917, and has been closed since 1945.

Minister for Mines has announced that Mining Bank, which buys ore for the Paipote smelter, will probably raise ore buying schedules by 40%.

Two samples of uranium ore from Chile analyzed by the French AEC have assayed a reported 0.55% and 0.60%. Uranium ores found to date in Chile are closely associated with intrusive rocks, especially diorites and granodiorites or

(Chile continued on p 182)

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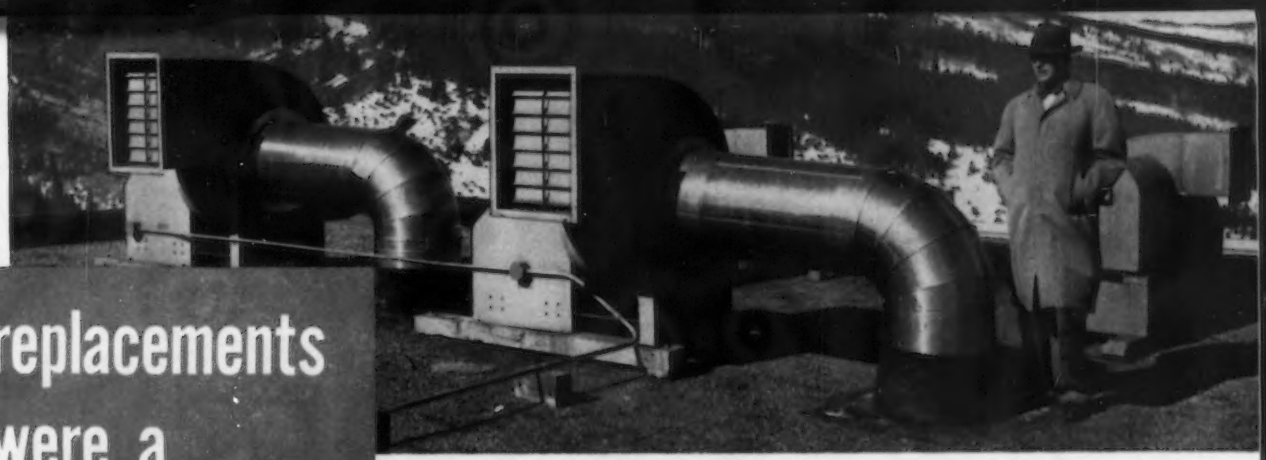

replacements were a problem, so—

"We rebuilt with Stainless Steel!"

says The New Jersey Zinc Company

These pictures were taken at the Gilman, Colorado, operation of The New Jersey Zinc Company—W. L. Jude, Superintendent. A few years ago, the company got fed up with the constant replacement of laboratory fume hoods. Because of the corrosive fumes, the previous hoods would look like sieves after as little as 3 months. They had a *maximum* life of 18 months.

Now the Stainless Steel hoods have been in service for 5 years, and they still look like new. The installation was not difficult. Less bracing and underpinning was needed because of the inherent strength of the Stainless Steel.

It is difficult to predict the life of these hoods, since they show no signs of failure. But, Mr. Jude says, "... at the very least, we expect them to last as long as the building."

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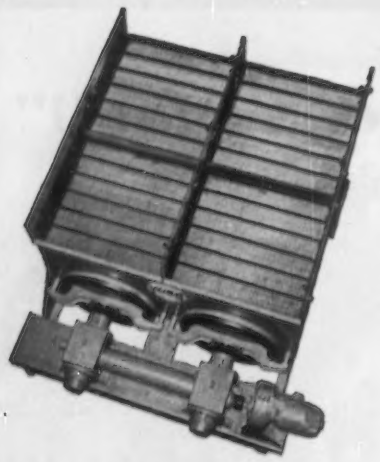

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Surface installations have been rebuilt, modernized. Tramway will carry more buckets and terminal bins will be enlarged to 600-ton capacity.

Cerro Opens San Cristobal

IN FEBRUARY, following a shutdown of several years, Cerro de Pasco Corp. put the San Cristobal mine, in the central Andean area of Peru, back into full production. San Cristobal had brief periods of production in the 1930's and 40's, but it was not until recently that new reserves, higher metal prices, and discovery of high grade copper, silver and some gold and tungsten encouraged the reopening. Superintendent Jack Semmens went to San Cristobal to start the present development in 1952, and opened full production in January 1955.

Modernization

In the time since Semmens arrived, the old levels were renumbered; exploration was begun on the old Central orebody for zinc mineralization reportedly left behind; 16 raises were driven into the Western orebody to outline the vein between levels.

Copper of 2% grade has been found in the lower levels and 1 million tons have been blocked out. Sphalerite is the principal mineral, but chalcopyrite and galena are increasing in quantity. Short-cycle flat back cut-and-fill stoping is employed.

The old shaft has been abandoned, after having been flooded, and one new four-compartment shaft is contemplated.

Mining is fully mechanized, with ore handled by scrapers. Ingersoll-Rand stopers, Joy double drum 15-hp ac slushers, air hoists, trolley locomotives and a new type XLE compressor are used.

San Antonio orebody, 4 km from San Cristobal, contains some silver, about 5% lead and 16% zinc. A tunnel is being driven on the 470 level from San Antonio and the Western orebody. One new vein has already been cut. A small prospect winze has been cut to explore the body in depth.

San Antonio, fourth in the group which includes Central, Western and Dike orebodies, produces at present some 60 tons per day, with 100 tpd output in the works. Ore is carried by truck to San Cristobal for shipment by tramway over the peak to the Mahr concentrator.

Plans now include mining the Dike by a modified longwall process. The orebody, which is flat in character, will go into full production when the tungsten plant, now under study, is finished in Mahr tunnel.

Surface installations, remnants of previous operations at San Cristobal, were found inadequate for present and planned operations. A new garage and electrical shop were built, the mine office extended, warehouse enlarged, cash and time office and miners' change room completed.

Present production rates at about 12,500 tons per month from seven producing stopes and six in preparation. Fifteen should be in production by midyear, to give 15,000 tons per month, and completion of 20 to 25 stopes by winter should provide 18,000.

Tramway Expansion

Bleichert bi-cable aerial tramway, installed in 1936, runs from the mine to the new concentrator at Mahr tunnel. Tramway is 12,000 m long, with a capacity of 30 tph. Plans include additional buckets to up the number to 150. Bin capacity at each end of the line will be increased to 600 tons. Modifications are expected to provide delivery of more than 216,000 tons yearly to Mahr concentrator.

Mine staff under superintendent Semmens includes, S. R. R. Hood, general mine foreman; R. McCombe, mine foreman; A. A. Van der Poel, assistant; A. A. Cole, assistant (outside mines); V. P. Jensen, mine foreman, shafts; K. R. Groschopp, engineer; Giles Walker, geologist; and Raimundo Chico, assistant geologist. Joe Ross is in charge of surface installations.

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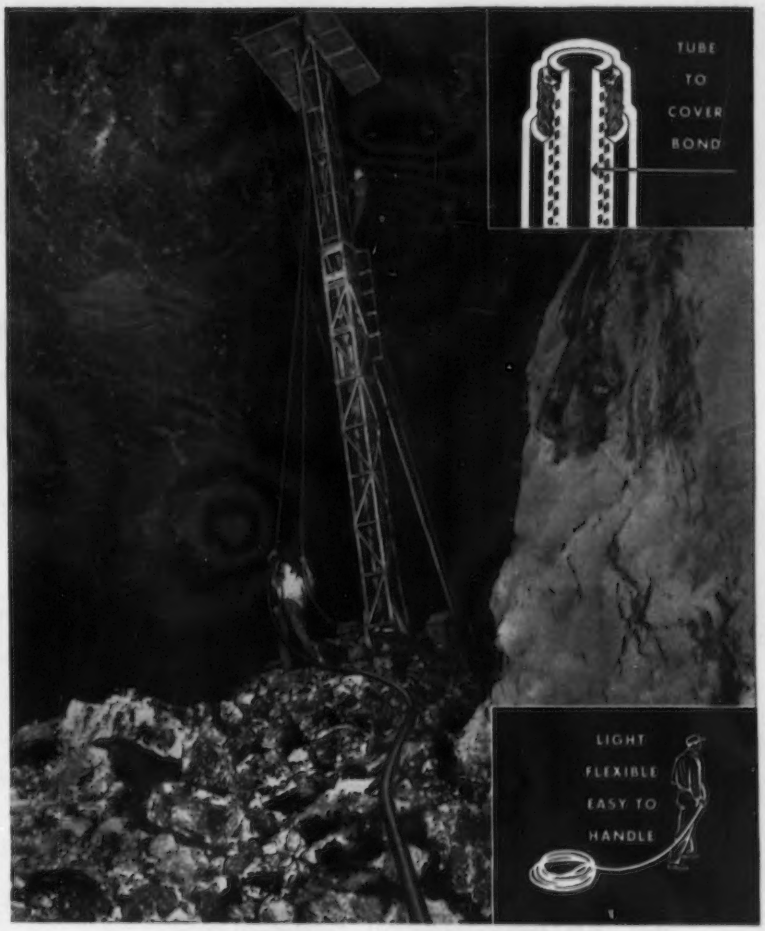

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Bluewater Expansion Continues in 1955

ANACONDA'S URANIUM PROCESSING MILL near Grants, N. M. (above), will see completion of expansion in the carbonate leaching plant (limestone uranium ore) in the second quarter of this year. Construction of acid leaching units (sandstone uranium ores) is set for late 1955. Increased expansion was begun in 1954 to handle ore from the huge Jackpile mine (below), discovered and developed by Anaconda Copper Mining Co.

Chile *(Continued)*

metamorphic rocks near the contacts with those rocks and almost exclusively allied to copper deposits. U. S. AEC is reported to have offered to purchase Chilean uranium.

R. M. and Alfred Grey, U. S. businessmen, will build a 100 tpd mill to handle the 8-million ton oxidized copper deposit near Iquique owned by Compania Cuprifera Sagasca, it is reported. Pilot mill will employ process to float chrysocalla minerals in the ore devised by Prof. Nathaniel Arbiter, Columbia University. (See *E&MJ*, February 1955.)

Mine will be worked by United Satamin Mining Ltd., Toronto. Grade of ore is said to be about 2.5%.

Mining Bank has published new copper ore-buying schedules (dated April 1, 1955). Changes in schedules are as follows: 10% ore, 11,500 pesos (from 11,070); 20% ore or concentrate, 38,000 pesos (from 27,300); and 30% concentrate, 60,500 pesos per metric ton (from 43,570). Free rate of exchange as last reported (early May) is 400 pesos to the U. S. dollar.

COLOMBIA

Output of gold and silver in 1954 showed a further decrease from 1953. Gold output dropped to 377,467 oz in 1954 from 437,295 oz in 1953 and silver output

performance of new SIMPLICITY GRIZZLY-FEEDER draws highest praise from user . . . E. W. Hallett

View showing discharge end of the Simplicity 3' x 10' Grizzly-Feeder.

A year ago Mr. E. W. Hallett, President of the Hallett Construction Company of Crosby, Minnesota ordered a Simplicity Oscillating Feeder with a grizzly deck. In a letter we received from him recently, he says: "That feeder works perfectly, and we have never had one pebble hang up on the grizzly part of it. We are very much pleased with it. I believe that it would feed 700 tons an hour if we were to call on it to do it." This is high praise indeed, but it is praise well directed, for the Simplicity Grizzly-Feeder is a new and important contribution to the mining and quarrying industry.

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This unit combines scalping and feeding in one operation, thus completely eliminating the old type apron conveyor and stationary grizzly. The savings are readily apparent . . . you gain additional plant room and save 50% in operation and maintenance costs. The unit is available in sizes from 2' x 8' to 6' x 12', and in capacities up to 1000 tons per hour. A request to us at Durand or to any of our many sales representatives will bring you full information about the Grizzly-Feeder.

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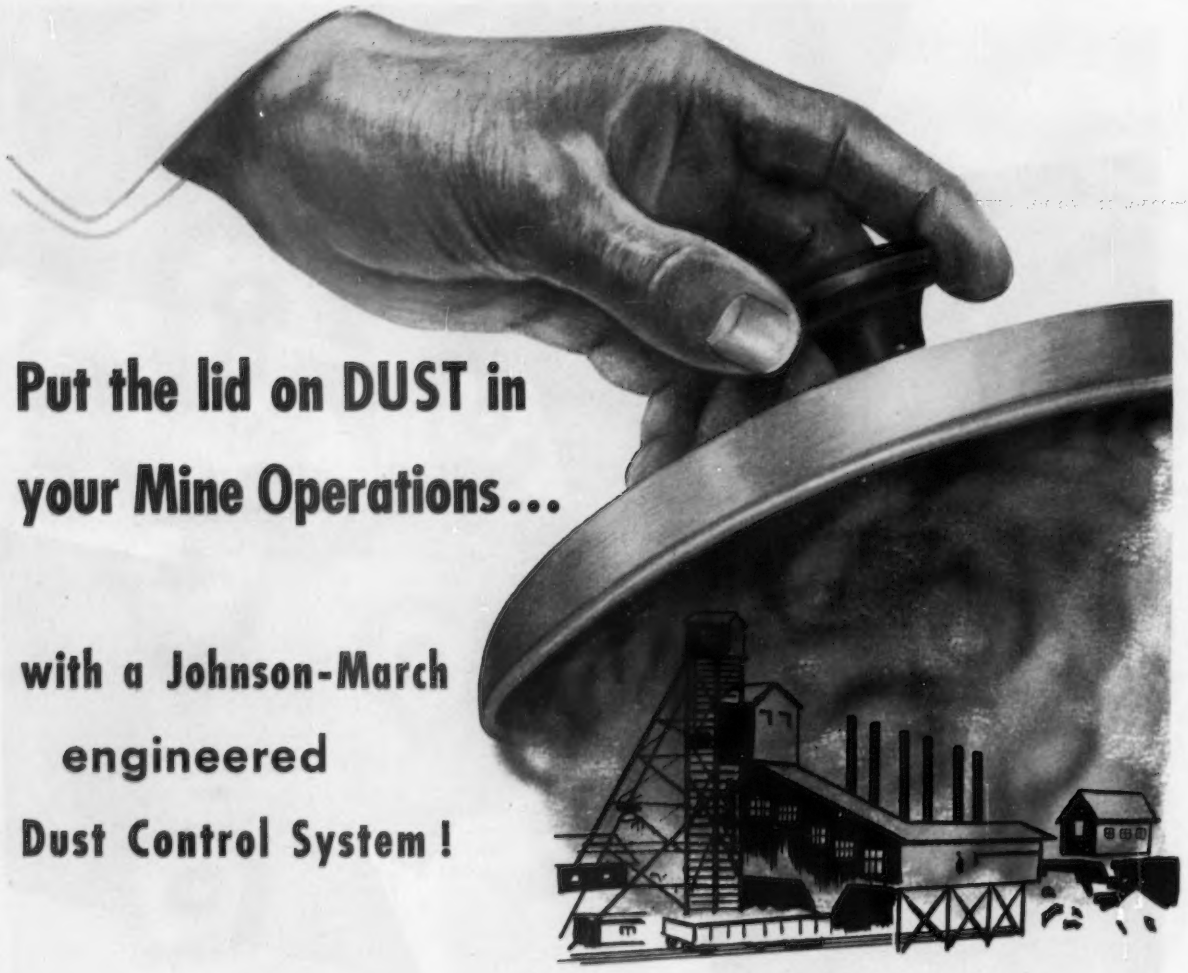

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Colombia *(Continued)*

reached only 112,534 oz in 1954 (117,383 oz in 1953).

Gold output in January 1955 reached 44,395 oz, more than during any single month in 1954. With new exploitations soon going into operation, it is expected that gold output will rise again.

PERU

Aerial photographic and photogrammetric surveys of the Toquepala and Quellaveco areas has been begun by a crew of Photographic Survey Corp., Ltd. of Canada, which arrived in Limatambo airport in late April.

PSC will also survey the Antimina area, of Cerro de Pasco, along with the property of the Northern Peru Mining & Smelting Co., owner of the Toquepala and Quellaveco properties.

Estimated production in Peru of minerals in 1954 are as follows: Lead, 92,532 metric tons; zinc, 143,330 metric tons; copper, 26,590 metric tons; silver, 650,000 kilos; gold, 4,000 kilos.

Final figures will not be available for some months.

VENEZUELA

Orinoco Mining Co.'s Cerro Bolivar operation will hit nearly 7-million tons per year, says Francis Thomas, president. British and German firms are expected to buy approximately 900,000 tons.

IN AFRICA

Drilling, disclosing a series of payable reefs between 4400 and 5700 ft, has encouraged plans for a new mine in the Orange Free State, southwest of Odendaalsrus. Middle Witwatersrand consulting engineers have submitted estimates and proposals for a demarcation of the first mining lease area.

Mine will be south of the Loraine mine and west of the northern part of the Freddies Consolidated.

Central African Federation has another hydroelectric scheme under consideration in addition to the Kariba Gorge and Kafue undertakings.

New Shire Valley project in Nyasaland, to cost some $220-million, includes a dam at the southern end of Lake Nyasa, irrigation and navigational schemes in the Shire Valley and hydroelectric plants to exploit the bauxite deposits in the Melanje district. New dam would permit Rhodesian manufacturers to deliver goods into the heart of east Africa.

About 30-million tons of rare mineral ores, including radioactive monazite containing thorium, have been discovered in a hill close to the Tanganyika border, it is reported. Detailed surveys at Mrima

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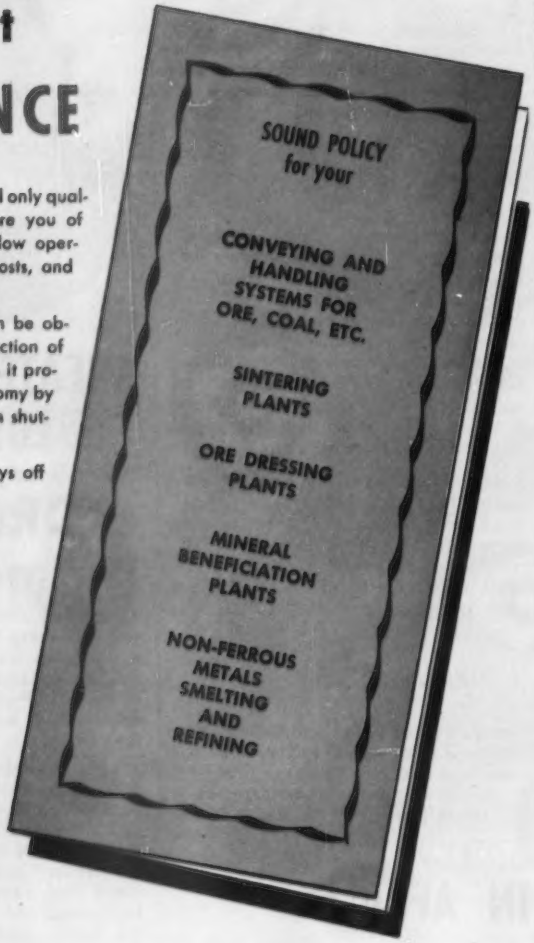

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TR-15

Africa *(Continued)*

Hill, about 50 miles south of Mombasa, have revealed that the ore deposits extend for about a square mile.

Mines Department said that several leading mining companies in Britain, U. S. and South Africa had already made inquiries about the deposits.

A $1.3-million company was formed in South Australia to supply Australian requirements with high-grade graphite carbon concentrates. It is expected that surplus production will be exported to the U. S. and United Kingdom.

About 600 acres of land, considered to be finest deposit in this part of the world, will be prospected at Munglinup in Western Australia. Tests have shown up to 99.6% of graphite carbon.

Buffelsfontein G. M. has installed modified ventilation equipment designed locally. A two-way sluice gate operated by a lever reverses the effect of the fan without changing the direction of rotation of the fan or switching it off. A saving of 30 to 40 minutes between blasting and cleaning operations in shafts sinking operation is reported. A further economy is that only a single duct system is required as opposed to the usual separate supply and exhaust systems.

Drilling operations in the Bethal area of the Transvaal, which lies due east of the existing Witwatersrand mines, have shown that it is underlain by payable Kimberley in valuable amounts. Application will be made to the government for a mining lease. Drilling operations are still in progress and, though no official news has been released, mining circles say that eventually up to six new mines can be established in the area.

Societe Anonyme Cherifienne d'Etude Miniere, largest producer of manganese in the French Union, produced 214,000 tons of manganese in 1954 compared with 206,000 tons the previous year. Company is a subsidiary of Mokta El Hadid.

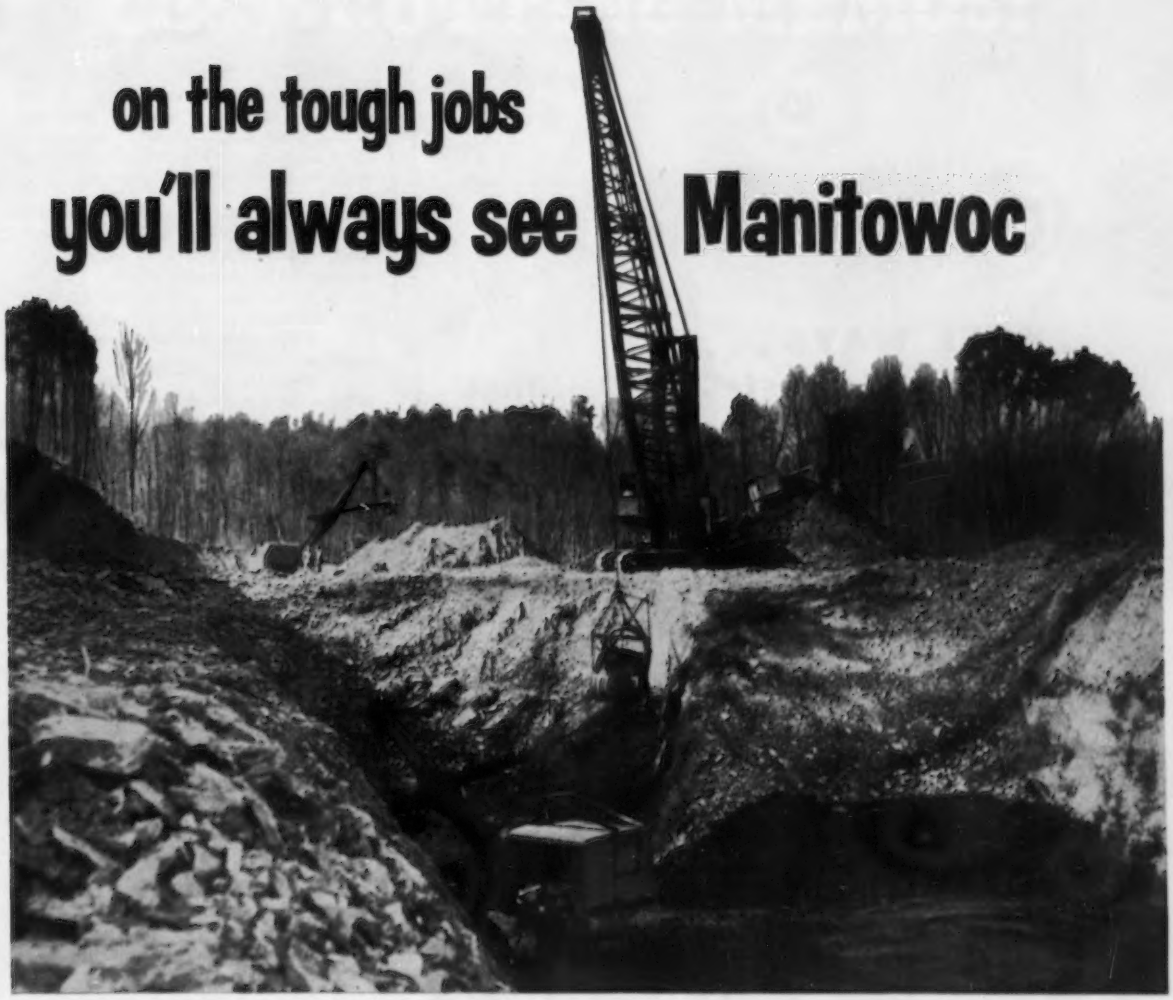
Societe les Minerais de la Grande Ile, exploiting a newly discovered uranium-thorium deposit, made its first delivery under contract to the French Atomic Energy Commission at Fort Dauphin, Madagascar. Delivery of 3 tons of uranothorianite concentrates was valued at 3-million francs (about $10,000). Proven reserves to date in the small deposit being worked are only 70 tons.

IN AUSTRALIA

New high grade iron ore finds in South Australia's Iron Knob area are being drilled and explored. First diamond drill has penetrated to 120 ft in high grade. Some ore shows presence of manganese.

Reports from Northern Territory claim discovery of what may become Australia's biggest manganese deposit. Find was made near Renner Springs, about 90 miles north of Tennant Creek.

on the tough jobs you'll always see Manitowoc



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Australia *(Continued)*

Bureau of Mineral Resources and geologists will examine the find. It may cheapen the price of uranium processed at the Rum Jungle plant as manganese for processing ore was shipped to Darwin from as far as Western Australia.

Australian Uranium Corp. N.L. reports that diamond drilling and mining indicated about 160,000 tons of ore containing 0.4% uranium oxide. Ore reserves so far discovered in the Adelaide River mine are sufficient for about seven years of operation and the company proposes to start full production within a year. Geologists say that the extreme richness of these discoveries lends support to the widely held geological opinion that the South Alligator River zone will produce outstanding developments.

Rio Tinto Co. Ltd. is now operating seven diamond drills on the Mary Kathleen uranium lease. Latest reports say that if and when a treatment plant is erected, its capacity would be fully employed in producing uranium oxide from its own leases. Australasian Oil Exploration Ltd. has also some 70 additional uranium leases in the Mt. Isa area and if sufficient ore is proved, it may need a second treatment plant.

IN THE PHILIPPINES

Field crews for Mindanao Mother Lode Mines examined twenty properties during 1954. Six were found worth further work. In La Union province, Bauang Beach sands were sampled and test work is now being done in U. S. to determine possibilities of producing an iron ore concentrate and a titanium concentrate of marketable grade.

For the past 10 months the company has been exploring the Cabapa property in the Botolan district of Zambales. By the end of 1954, diamond drilling had indicated an orebody of 150,000 tons of 3% copper on the north vein. Poor core and sludge recovery on the South vein has prevented an estimate of ore from that area. Tunneling started early in January to check up the drilling. Drive to open up the vein on the 100-ft level by March had advanced 350 ft. Besides the north and south veins, five other outcrops have been located. Other claims within 10 km of the proposed mill site with encouraging copper indications are under examination. The company is dismantling and crating equipment and supplies at the old Surigao mine. It was estimated that removal would start May 1 and be completed by Aug. 1.

Toledo copper mine of the Atlas Mining & Development Co. is now in regular production.

Over 3,000 tons of concentrates with an average recoverable copper content of 23% awaited shipment at the end of April. Difficulty had been encountered

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Philippines *(Continued)*

in finding freighters to move the concentrates, but 5,700 tons are now scheduled for shipment to Japan. By the end of May it was expected to start shipments to Tacoma.

Mine delivered 89,566 tons to the crushing plant during April and 95,400 tons of oxide ore to the stockpile. Waste stripping from March 1 totaled 288,400 cu yd.

Construction work on the mill and power plants is about completed, but the crew will be retained for the next 3 or 4 months while work goes on to expand the plant's capacity to 6,000 tpd. About 250 men are working on the bins and loading facilities at Sangi.

From Annual Reports

In E&MJ's May issue, p 72, annual reports from some of the world's leading mining companies were summarized. Following are digests of highlights of other annual reports received by E&MJ.

International Nickel Company of Canada, Ltd. paid both common and preferred dividends based upon increased production of nickel (282-odd-million lb), about 70% of the world's supply, and based upon cost reductions of copper by the one-year-old oxygen flash smelter (1,000 tpd).

Canada's first commercial electrolytic cobalt plant went on-stream in 1954. Ore reserves increased to 261-million tons of ore. Copper-nickel content also increased. $16-million pyrrhotite plant for iron ore production was scheduled for operation this year.

Exploration continued to add reserves with large scale prospecting in Ontario, Manitoba, N. W. Territory, Saskatchewan and 12 countries outside of Canada. Shaft sinking at Moak Lake to begin underground exploration of the orebody is planned for this summer.

La Luz Mines, Ltd. milled ore averaging 0.0978 oz gold at an average 1,989 tpd in 1954. All mining is underground.

Noranda Mines Ltd., Canada Gaspé Copper Mines was about ready to begin concentration. Concentrate will be stockpiled to await completion of the smelter. Sulphur-iron plant at Port Robinson began operations at 70,000 tons pyrite a year. West Macdonald Mines will begin producing in July. An agreement has been made to build a 300-ton cyanide mill near Wenatchee, Wash.

Prospecting was continued in New Brunswick, Quebec, Ontario, Manitoba, Yukon, Saskatchewan and British Columbia. Bathurst property in New Brunswick will be explored in 1955. Sulphide deposit in Opawica, Ontario, is being diamond drilled. Sudbury and Blind River drilling was not encouraging, but further work was planned for Blind River. Manitouwadge option was dropped. Mystery Lake drilling was inconclusive. Copper orebody in Vancouver may be limited.

National Lead Co. Construction of the Fredericktown, Mo. refinery was completed; start-up is in progress. Birmingham, Ala. iron ore pilot plant was started

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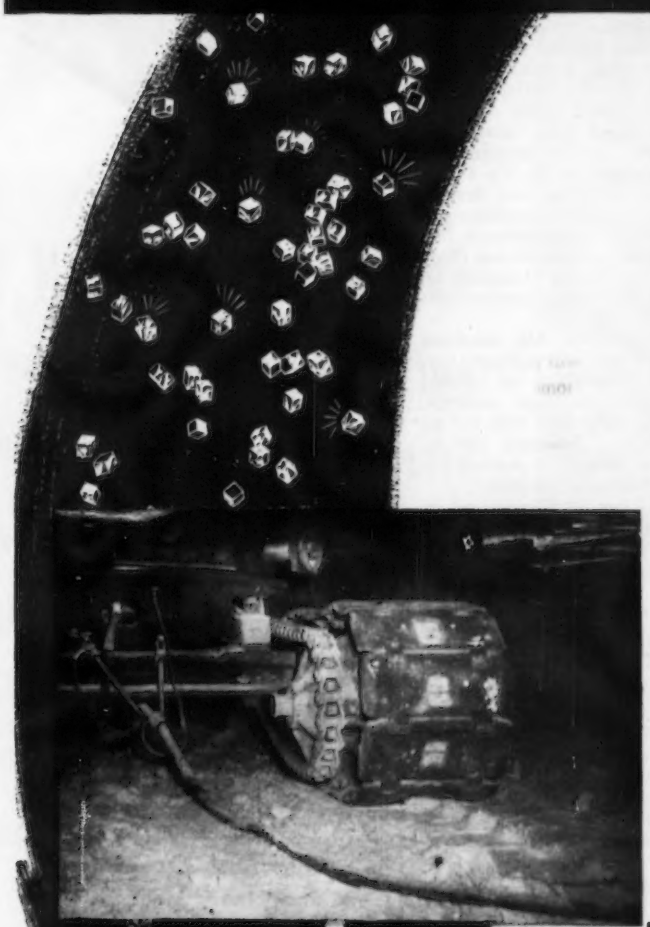

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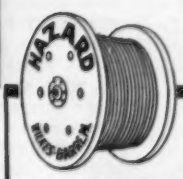

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"AFCO" PRODUCTS

Annual Reports *(Continued)*

in December 1954. Major expansion of Mina Castano, Argentina property, underway. Titanium Alloy Mfg. Co. has begun plant expansion to handle newly-explored ore reserves of rutile in Australia. Company signed with AEC to operate AEC's raw materials development laboratory at Winchester, Mass., and Grand Junction, Colorado. Titanium Metals Corp., partly owned by National Lead, operated at 10 tpd metal. $43-million expansion of the Nicaro project (of which National is major owner) was authorized by GSA.

Shattuck Denn Mining Corp. had a profit for the year producing: 18-odd million lb zinc, 7-odd million lb lead, 207,331 lb copper, 18,082 oz gold, 574,085 oz silver plus undisclosed amounts of vanadium and uranium. Iron King mine operated on 10, 12, 13 and 15 level with exploration and development continued. $900,000 expansion program begun in 1951 was completed. Zuni Milling Co. plant in New Mexico (fluorspar) was down all year. Uranium ore shipment from property in Uravan, Colo. began in March 1954.

King Island Scheelite, Ltd, Australia. 1,146 tons scheelite concentrate were produced. Ore reserves as of October 1954 were 3,164,000 tons averaging 0.48% WO_3. A blast-hole drill for the open cut mine was purchased. Ore exploration further defined the deposit with 8,115 ft of drilling accomplished.

Vitro Corporation of America net income increased in 1954 with mining and milling operations picking up everywhere. An amended 5-year contract calling for 50% expansion, at a cost of $300,000, was completed with AEC. Salt Lake City mill was operating at the new level by December 1954. Good ore stockpiles were on hand. Vitro Rare Metals had a loss for the year due to a major transformation. Vitro Minerals Corp. was formed to handle Blind River uranium holdings.

Roan Antelope Copper Mines Ltd., Northern Rhodesia mined 5.3-million tons ore by extension steel and diamond drill methods, and produced 88,678 tons copper in 1954. 31,829 tons were refined overseas into electrolytic copper while the rest appeared as blister. Operating costs were up from the previous year but the company still managed to make £9-million gross profit. Construction of a new electrolytic plant at Ndola, having 60,000 tons copper a year capacity, was planned. Railroad bottleneck, due to increased activities of all the Copperbelt mines, has not been licked. Board chairman R. L. Prain stated that the issue of African advancement is the most serious single unsolved problem.

Aluminium Ltd. of Canada made capital expenditures of $48-million during 1954. Kitimat-Kemano project started producing aluminum after 3½ years of construction. 2,201,000 tons of bauxite from British Guiana and 495,000 tons from French West Africa augmented the 230,000 tons alumina produced from bauxite at the Jamaica property, 560,900 tons primary aluminum were produced.

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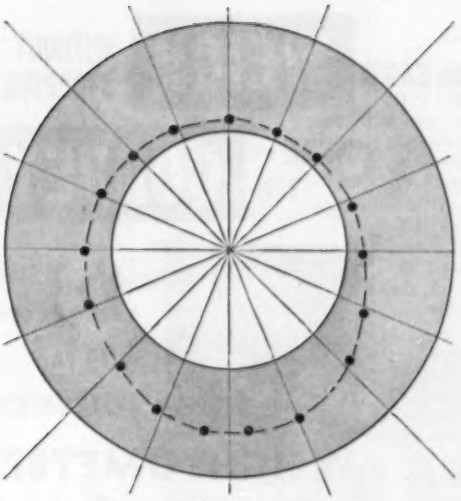

Average wear pattern for phosphate pipe.

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The abrasiveness of the phosphate matrix slurry cannot be controlled. But choice of pipe and pipe turning schedules are factors that can greatly extend the life of phosphate matrix pipe.

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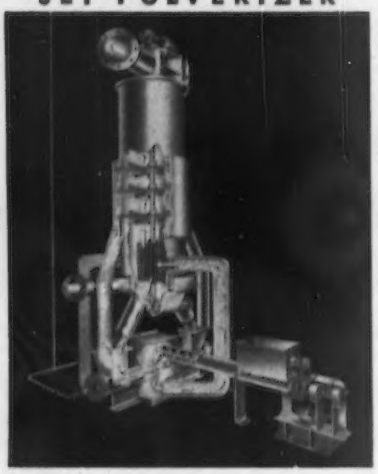

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Annual Reports *(Continued)*

Jamaica plant will up its output from 230,000 to 300,000 tons alumina. Volta River Project, Gold Coast, West Africa is still in planning stage. Exploration during the year resulted in establishing bauxite reserves capable of feeding the four Quebec smelters and the Kitimat plant for the next 50 years.

Goodyear Tire & Rubber Co. Goodyear Atomic Energy Corp. passed the half-way mark on construction of the uranium 235 separation plant for the AEC.

Tennessee Corp. annual report announced contract with AEC for the recovery and sale to the commission of uranium extracted in superphosphate production. Process has gone through several years pilot plant operation.

Texas Gulf Sulphur Co. earning exceeded any other year in the company's history. Demand for sulphur equal to production kept sulphur above ground at the 1953 level. Purchase of oil rights at the Spindletop Dome, Texas area continued. Explorations in Mexico and acquisition options proceeded as planned.

Sodak Uranium & Mining Co. produced 600 tons of uranium ore from Joe Smith group. Preliminary exploration began at Dennis lease, Crook County, Wyo., and disclosed 2,000 tons of ore on initial drilling. Shipment from the lease was started in May 1955. Phillips orebody, Fall River County, S. Dak. was purchased. Mining will begin in May or June 1955.

M. A. Hanna Company, Cleveland, produced 11.4-million tons iron ore in the U. S. during 1954. 1.75-million tons came out of the Quebec-Labrador mining region. Four year development program of Hanna and Iron Ore Co. of Canada cost $250-million. Construction continued at the Riddle, Ore. nickel smelter which will process ore from Nickel Mountain mine. Commercial production of ferronickel will begin in 1955.

American Smelting & Refining Co. Capital expenditures in 1954 amounted to $9,497,000. Silver Bell Mine was completed and work begun at Black Lake, Que. Explorations at Galena Mine, Wallace, Idaho yielded additional ore reserves.

In Mexico construction of the mill at Nuestra Senora lead-zinc-silver property was completed. Mill was designed for Rosario property after exploration produced favorable results. San Pedro Mine was purchased. Options on fluorspar property were taken in Paila District.

Active exploration and development work at Mount Isa, Australia added to the ore reserve.

Southern Peru Copper Corp. (57¾% AS&R) proved 400-million tons copper ore at the Toquepala property. A five year mine, mill and smelter construction program was begun. AS&R's share will be $40-million.

Inland Steel Co. 1,389,589 tons iron ore were produced. Morton Ore Co. on Mesabi Range, finished it first year of operation. Cayia Mine at Crystal Falls, Mich. was closed down permanently and

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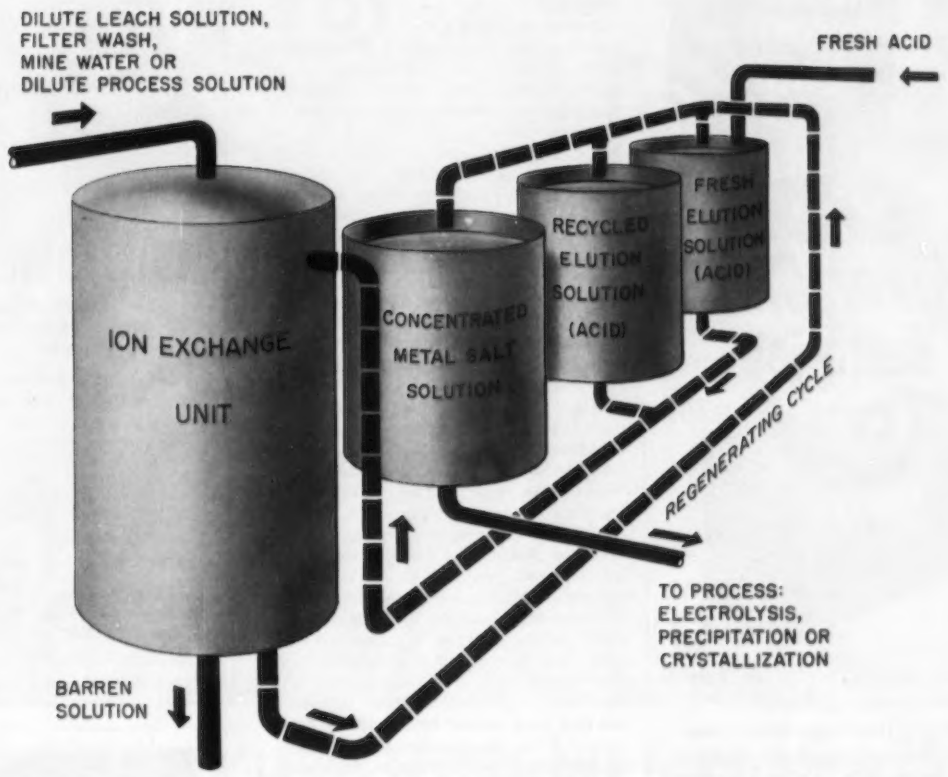

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Annual Reports *(Continued)*

abandoned due to caving problems. Marion, Kentucky fluorspar plant was closed and facilities sold. At Falls Bay on Steep Rock Lake, dredging began.

American Metal Co., Ltd. Mechanical charging machines were tested successfully at Blackwell, Okla. Bismuth refinery at Monterrey, Mexico completed first year of operation. Construction of the new metallurgical control and development laboratory at Carteret, N. J., was completed. Torreon, Mexico pilot plant recovery of zinc from lead slag was successful, but plant construction must await more favorable investment climate. Production of copper was 169,000 tons electrolytic; lead 90,200 tons. Southwest Potash Corp. completed second year of operation. By the end of 1954 electronically pure germanium dioxide was being produced in Belgium. Company holds shares in: Chibuluma Mines, Ltd. which made progress on their copper-nickel property in Northern Rhodesia, where a cobalt plant will be erected; Baluba Mines, Ltd. and Chambishi Mines, Ltd., whose extensive orebodies are not being mined at present; and Roan Antelope (see above).

United States Steel Corp. shipped 3.4-million tons iron ore from Venezuela property. Manganese exploration and development continued in French Equatorial Africa and at Urucum, Brazil. Total iron ore production by USS was 37.3-million tons (21.2-million tons less than 1953). 25.2-million tons limestone and flux were mined by subsidiary companies. Tests on agglomeration of taconite and other fine ore types were conducted at their research center.

Homestake Mining Co. milled 1,485,226 tons of ore which yielded $18,409,610 in bullion. Only a slight decrease in profit occurred mainly due to improved mine and mill techniques. Sinking below the 5,000 level will begin shortly. Tonopah silver-gold prospect was abandoned due to low tonnage. Carlisle, Wyo. uranium open pit was mined out at a profit in 1954. New Haven deposit will be mined out by summer. 3550 ft tunnel was driven to provide access to the uranium ore block on the Little Beaver Mining property. Mineralization, although locally high grade, was spotty. Raise into orebody was completed. Shaft was sunk to 572 ft. on La Sal Mining & Development Co. property, which Homestake has contract to purchase, and struck uranium ore as expected. Commercial ore was indicated on the Alice property but no development plans will be started until work on other properties is completed.

Opemiska Copper Mines, Ltd., completed its first year of operation having treated 134,879 tons ore which yielded: 14,047,210 lb copper; 6,259.6 oz gold; and 76,714 oz silver. Number 3 zone most promising area. Shrinkage stoping applied throughout the mine with 19 stopes working by the end of year. Ore reserves were calculated at 1,445,570 tons averaging 4.76% copper.

(Reports continue on p 200)

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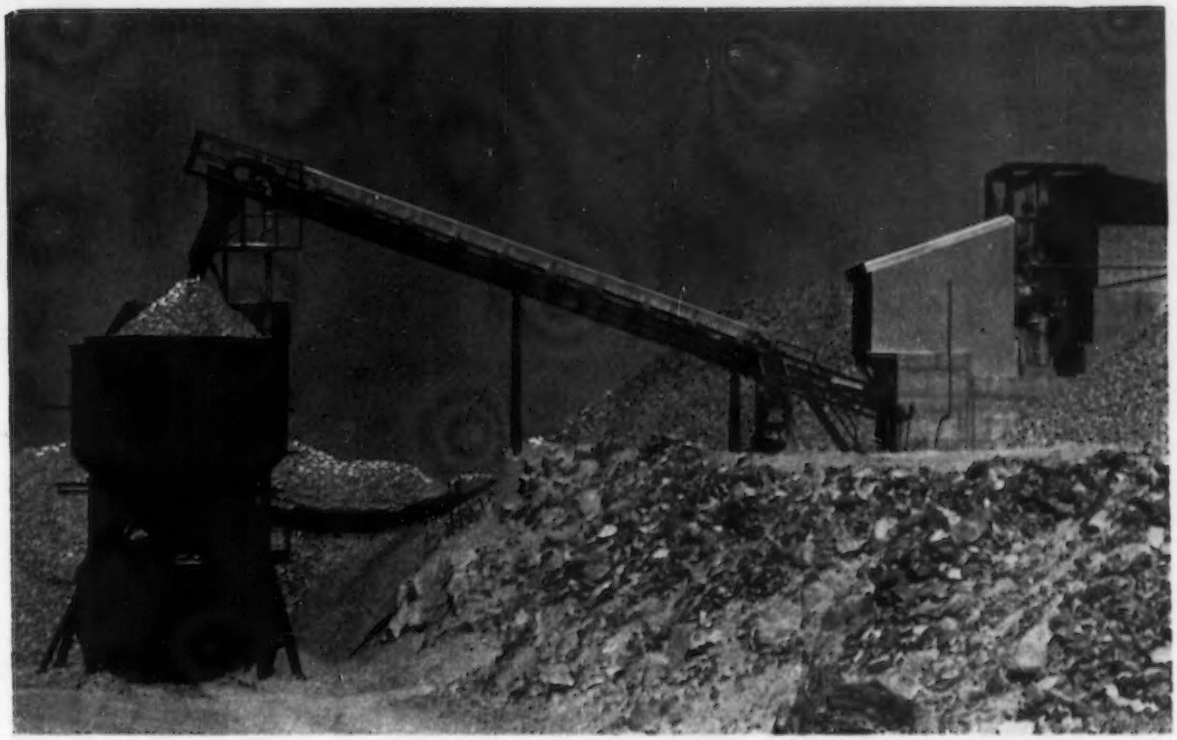
KUE-KEN is the lowest price crusher



With its higher operating speeds, Kue-Ken crushes 25% to 50% more rock per inch of jaw width than any other crusher

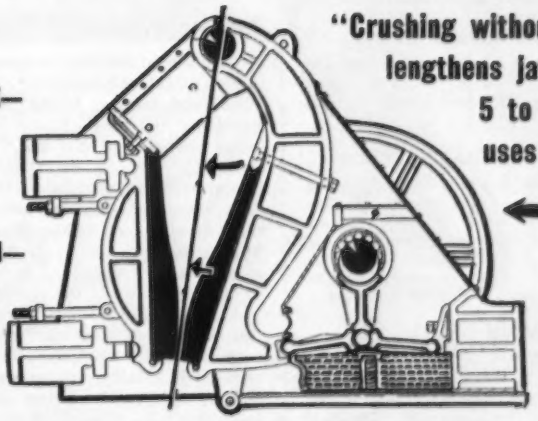
(and crushes finer)

NO SHAFT OR FRAME BREAKAGE—

a built-in safety device releases flywheel instantly on overload. No shearing or breaking parts. Quickly reset.

CRANKCASE TYPE LUBRICATION—

Kue-Ken is the only crusher whose mechanism operates in a bath of filtered, dust-free oil. Mechanism is protected from wear for life of crusher. Toggles do not wear out. Change oil twice a year.



"Crushing without rubbing" lengthens jaw plate life 5 to 10 times... uses less power

See how the Kue-Ken hinge pin is located on the centerline of the crushing zone. The jaw moves in an almost straight line Rock is instantly gripped and crushed without rubbing.

KUE-KEN CRUSHERS

"LOWEST COST-PER-TON CRUSHING"

Jaw Crushers Gyratory Crushers Overhead Eccentric Crushers Revolving Screens Classifiers Feeders Rib Cone Ball Mills Concentrating Tables Vibrating Screens

Write for catalogs

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DEALERS: WASHINGTON MACHINERY CO., Seattle, Wash.; LUND MACHINERY CO., Salt Lake City, Utah; CLOSNER EQUIPMENT CO., San Antonio, Texas; CONTRACTORS EQUIPMENT CO., Portland, Ore.; GARLINGHOUSE BROS., Los Angeles, Calif.; ANAHUAC MACHINERY CO., Mexico City, Mexico; UNIVERSAL EQUIPMENT CO., Vancouver, B. C.

Pennsylvania Crusher Co., Exclusive Licensed Eastern Manufacturer and Distributor, 323 S. Matlack St., West Chester, Penn.
Armstrong Whitworth (Metal Industries) Ltd., Authorized Licensed Manufacturer and Distributor. Close Works, Gateshead-upon-Tyne 8, England

THE
OUTSTANDING
MINE VENTILATION
LINE

Outstanding
✓ FOR QUALITY
✓ FOR DEPENDABILITY
✓ FOR COMPLETENESS

ABC BRATTICE CLOTH

7 types to fit all needs—3 types of jute cloth, 2 types of cotton, plastic and Black Ace for non-gaseous mines. Carefully processed to resist flame, except Black Ace, and to resist mildew. In widths and lengths for any seam.

MineVent

FLEXIBLE VENTILATION TUBING

Made in two grades; the jute base and cotton base, synthetic rubber coated. Resists leakage, abrasion and moisture. Available in 9 diameters, 8" to 36" and 25, 50 or 100 ft. lengths. Choice of 3 types of suspension, demountable patented Snap-On coupling or Sewed-In coupling. Most widely used mine ventilation tubing.

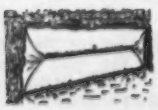
NEOLON FLEXIBLE VENTILATION TUBING

The new Neoprene coated Nylon fabric tubing. Almost impossible to tear. Airtight. Resistant to abrasion, acid mine water and flexing. Same lengths and diameters as MineVent.

NON-COLLAPSIBLE TUBING

Both MineVent and Neolon are available with telescoping spring wire inserts rendering the tubing non-collapsible. Light weight. Economical.

ABC INFLATABLE BRATTICE



Sizes to fit any opening. Readily fills rough contours, jagged walls, etc. Quickly inflated by special hand pump. Quickly deflated to move to new location. Easy to transport. Economical to use.

ABC POWDER BAGS

Rubber coated durable fabric, firmly sewed, for long use and hard wear. 5 sizes: 20, 36, 60, 125 and 160 sticks of explosive.

Send for Catalog 55.

ABC AMERICAN BRATTICE CLOTH CORP.

220 So. Buffalo St., Warsaw, Indiana

Morocco's Phosphate Rock Tops 5-Million Mark

MOROCCO'S PHOSPHATE ROCK INDUSTRY, producing about 25% of the Free World's supply, set a new record in 1954. Over 5-million tons of rock was mined compared with 4,196,000 in 1953 and 4,520,000 in 1951.

Important factor in the high production was newly exploited deposits at Oued Zem which last year added 400,000 tons. Two well known deposits at Khouribga (reserved 150-million tons 70%), produced record quantities at 3.4-million and 1.2-million tons respectively. Both areas have been operating largely by hand and pneumatic drill mining with automatic conveyors from the mine face.

Oued Zem deposit (reserve 20-million tons) is not only producing a higher quality (76%), but is also using open pit mining methods. Bucyrus-Erie draglines are being used to remove overburden and for active mining at the face.

Principal customer for Moroccan phosphate rock remains the Sterling Bloc, the United Kingdom and South Africa, which during 1954 took 1-million tons, followed by Italy, France and Spain. Germany, Holland and Belgium remained important buyers, but in these markets, competition from Florida rock was an important factor. Japan, which since the war has been a U. S. market, began to receive some Moroccan rock during the past year.

Production of Moroccan phosphate is a government monopoly. Profits represent a main source of government income.

Kelley (*Continued from p 120*)

In his final address as chairman, Mr. Kelley told stockholders that "Anaconda's future was never so bright. Many of the problems that have plagued us are now being solved and our entry into new fields will increase the stability of our operations. Completion of the postwar construction program will bring expenditures in excess of $400-million on these improvements. Some of the developments are now beginning to be reflected in earning power of the company.

At the time Anaconda Copper Mining Co. was adopted as the name of the corporation, the company was primarily engaged in mining, milling, smelting and refining copper, Mr. Kelley pointed out. Since that time, however, it has branched out into fields far removed from copper mining. It has acquired fabricating facilities — American Brass Co. and Anaconda Wire & Cable Co. Anaconda produces 20% of the domestic zinc output; accounts for 90% of total domestic production of manganese; is building an aluminum reduction plant, with the first pot-line expected to begin production July 1; and is developing and producing uranium in New Mexico.

Pacific Northwest AIME Meeting Hears Top Miners

MORE THAN 200 delegates heard scores of technical papers and participated in tours of Kaiser Aluminum and Chemical's Mead and Trentwood plants at the Pacific Northwest Regional Conference, American Institute of Mining, Metallurgical and Petroleum Engineers, held in Spokane April 28, 29 and 30.

Other highlights of the three-day program were the metals branch luncheon, symposia on geology, minerals beneficiation and extractive metallurgy and demonstrations and discussions of X-ray fluorescent analysis.

Pacific Tin Buys Feldspar Mine

FELDSPAR CORPORATION, wholly-owned subsidiary of Pacific Tin Consolidated Corp., has completed the purchase of the outstanding stock of the feldspar mining and milling companies located in North Carolina, Tennessee and Georgia. Purchase was initiated in 1954 and cost of acquisition was $2.9-million cash.

Birdsboro-Buchanan Jaw Crusher

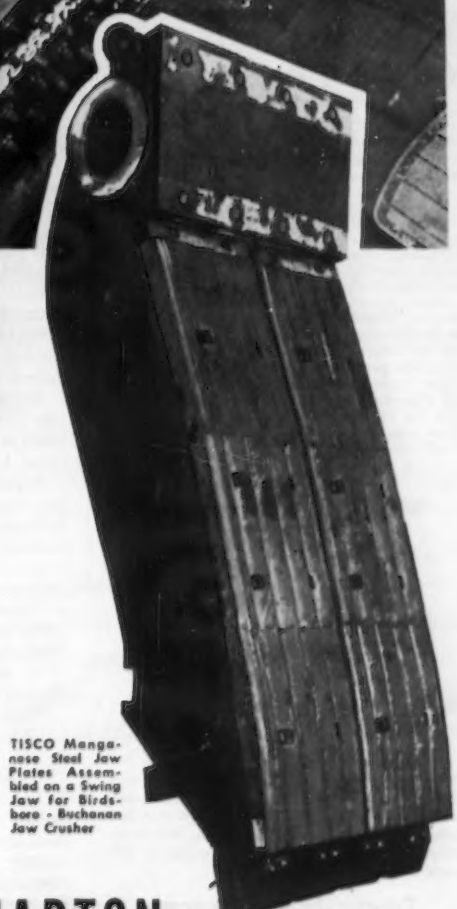
TISCO® helps Birdsboro-Buchanan Crushers

get more production without interruption

Jaw plates of TISCO Manganese Steel are used in Birdsboro-Buchanan Crushers because of the extraordinary property of this material of developing an extremely hard, abrasion-resistant surface in use under impact. This assures greater production with less down-time for replacement, indicating the value of TISCO Manganese Steel both for original equipment and for replacement parts.

Taylor-Wharton has made a specialty of alloy steels to resist impact and abrasion. Among the newer alloys developed by this company are TISCO 150-Y, a high chrome cast iron that can be heat treated to 700 Brinell, and TISCO 50. The latter is a heat hardenable medium manganese chrome molybdenum steel capable of hardness from 300 to 500 Brinell. Both alloys are strongly resistant to abrasion, where heavy impact is not present.

If your problem is one of impact or abrasion, or a combination of both, get in touch with us. When ordering replacement wear parts, order from manufacturer of the equipment and specify TISCO Alloys.



TISCO Manganese Steel Jaw Plates Assembled on a Swing Jaw for Birdsboro - Buchanan Jaw Crusher

Use TIMANG Weld Rods and Shapes for rebuilding and repairing wear parts.

TAYLOR-WHARTON Iron and Steel Co.

(Division of HARRISBURG STEEL CORPORATION)

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Cincinnati, O. Birmingham, Ala. Easton, Pa.

Want to slash operating costs...

get more tons per man-shift . . . and higher total tonnage?

Switch to

LONG PIGGYBACK® CONVEYOR

Continuous Haulage Mining

The Piggyback Conveyor system provides uninterrupted haulage from the face . . . eliminates costly loading delays common with "stop-and-go" transportation of other systems.

Every day more and more companies are learning that Piggyback Conveyor mining pays off in greatly increased production at greatly reduced operating costs. In fact, at many mines, this unique system has meant the difference between operating at a profit instead of a loss.

With proved, practical Piggyback Conveyor mining, material is loaded and moved out in a steady, continuous flow—with no down time waiting for intermittent transportation. The result: more tons per man—higher total tonnages. What's more, capital investment per ton for installing the Piggyback Conveyor system is much lower than for any other continuous mining method. Want complete details? Write us today—there's no obligation.

*Trade Mark

Units of the Piggyback Conveyor System

The receiving end of the Piggyback Conveyor is attached to the Pigloader Loading Machine and follows it as it moves. Thus, the operator can devote his full attention to loading. Wishbone pivots make possible continuous haulage at 90° angle breakthroughs.

For complete details or a demonstration, write us today!

The LONG Company

Annual Reports *(Continued)*

Howe Sound Co. produced during 1954: copper, 32,138,333 lb; lead, 26,541,819 lb; zinc, 46,111,931 lb; silver, 1,114,792 oz; and gold, 105,287 oz.

Copper Range Company completed mine, mill and smelter construction at White Pine property. Present ore reserves at White Pine were estimated at 309,660,000 tons averaging 21.3 lb copper. Smelter capacity will be about 6-million lb copper per month. Champion Mine yielded 336,741 tons ore from which 4,157,588 lb copper were recovered at the Freda mill.

Consolidated Coppermines Corp. produced 18,388 tons copper, 46,908 oz silver and 134,020 lb manganese from 2,670,130 tons of ore. All ore was treated at Kennecott's McGill concentrator.

Jones & Laughlin Steel Corp. produced 3,681,000 tons iron ore, 4,892,000 tons coal and 1,283,000 tons limestone in 1954. J&L has five open pits on Mesabi Range and one at Benson mines, St. Lawrence County, N. Y. Capacity at Benson was expanded to 1,792,000 tons ore. Tracy Mine on Marquette Range, Mich. will be completed by 1956. New open pit in Minnestota will be operating by 1956. Ore reserves were 140-million tons, not including low grade (other than Benson). Pelletizing of lean ores has reached pilot plant stage.

St. Joseph Lead Co. mines and mills in the Southeast Missouri section milled 7,182,035 tons ore with 97,599 tons lead recovered. Indian Creek mill will have a capacity of 2,000 tpd by end of 1955. Hayden Creek mill was abandoned and will be dismantled. Herculaneum Smelter (100,000 ton capacity) was completed.

Balmat, N. Y. mill finished first year with 103,479 tons concentrate.

Cia. Minera Aquilar, Argentina is continuing modernization program after a record net income year in 1954.

Brunswick Mining & Smelting in Canada completed pilot mill and auxiliary shaft with increase in ore reserve indicated by drilling.

Republic Steel Corp. reported iron ore reserves for next 50 years through purchase of controlling interest in Liberia Mining Co., Africa, a one-sixth interest in Iron Ore of Canada and a 50% interest in the Reserve Mining Co. Work continues on Alabama sandstone concentration project. Republic has substantial iron ore concession in Venezuela and is exploring an orebody in Peru.

Pacific Tin Consolidated Corp. dredged 13,983,000 cu yd and recovered 3,961,169 lb of tin. Dredging reserves were 72,045,000 cu yd containing an estimated 27,134,500 lb of tin. This does not include areas mined by tributers. This does include certain areas not suitable to mining until local guerrilla action is suppressed. Company holds share in Feldspar Corp. in U. S.

Madsen Red Lake Gold Mines, Ltd. milled 286,246 tons ore and recovered gold valued at $2,818,462.90. Ore reserves were estimated at 850,560 tons of 0.299 oz gold. Prospecting did not uncover any new orebodies.

NEW! for U_3O_8

1955 MODEL DR-299 NUCLIOMETER

3 INSTRUMENTS IN ONE... NO PRICE CHANGE!

$545.00 IN USA

Check these unique features!

- **THREE IN ONE:** Probe Geiger—Radiometric Assays—Ultra-sensitivity for low level radiation.
- **ALOFT OR ON WHEELS:** Low level anomalies at a glance. 4 time constants, 6 ranges from 20.0 to 0.01 MR/HR, for surface or carborne work!
- **HOT OR COLD:** 6 miracle Bismuth, 18 powerful Geiger tubes defy temperature extremes. No more heat failure of delicate crystals and circuits!
- **COMPLETE:** Instrument includes rugged leather case, probe, assay-sample holder. Nothing else to buy! Pack weight, just 10½ lbs.
- **GUARANTEED FOR SURE:** Take 10 days to prove it! Return in new condition for cheerful refund if you don't think this instrument is absolute tops!

May we bid your exploration, ore finding or management job? Airborne methods & photogeology by mining geologists with 30 years cold-dollar experience. Open pit or underground exploitation from claim to concession. Write or wire for details.

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PQ SODIUM SILICATES

economical flotation chemicals

Flotation of a wide variety of metallic oxides and non-metallic minerals is successfully promoted with PQ Sodium Silicates. They are effectively used as low priced dispersing agents and gangue depressants.

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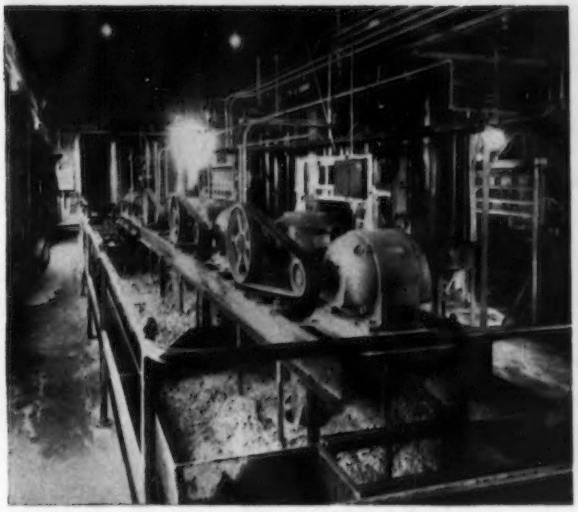
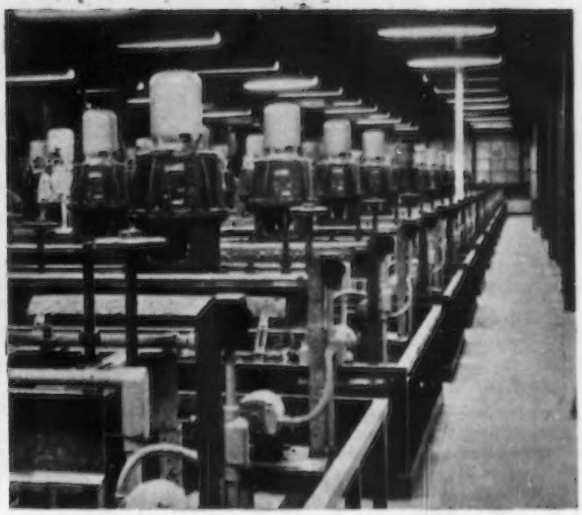
GENERAL AMERICAN TRANSPORTATION CORPORATION



Turbo Aerators and Flotation machines on coal (at Saegertown, Pennsylvania).



Turbo Flotation machines on phosphate ore (International Minerals & Chemicals Corp. Noralyn Plant—Mulberry, Florida).

high production
low maintenance
with TURBO
on the job

Peak production requires *continuous heavy duty service . . .* especially for minerals beneficiation and extractive metallurgy. That's why leading firms such as International Minerals, Nickel Processing, Vitro Uranium and American Smelting and Refining choose Turbo-Mixers.

Many Turbos are on their second 100,000 hours of 24-hour continuous service with no more than normal scheduled maintenance. A Turbo engineer is available to work with your engineers for your *high-production low-maintenance program.*

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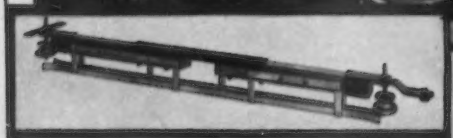
OTHER GENERAL AMERICAN EQUIPMENT:—DRYERS • DEWATERERS TOWERS • TANKS • PRESSURE VESSELS

Announcing a New Arrival...

The 'Canton' AIR POWER DOOR

The new American Mine Door Company *Air Power Door* is a proud new member of labor-saving doors for safety. Where feasible, the mechanically operated Type Z Door is recommended. Now this *new type P Door* is available where space is limited or where haulage roads are muddy. Activating mechanism is installed on top of the new Type P Door; operated by motorman throwing manual contactor or automatically by a trolley contactor. Doors open very fast . . . end of swing is completed very gently. Door wings may be completely metal clad if desired.



Other "Canton" products: Electric Track Switch Thrower, Automatic Track Switch De-railer, Rock Dusting Machines, Car Transfers (passers), Finger Boards, Cable Splicers, Cable Terminal Binders, Welding Bond Terminals, Shaler Cable Vulcanizers, Track Cleaners.

Write for complete descriptive literature. Please use street and zone numbers.

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35 Years of EXPERIENCE

SINKING SHAFTS
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CONSTRUCTION COMPANY
SAINT LOUIS, MISSOURI

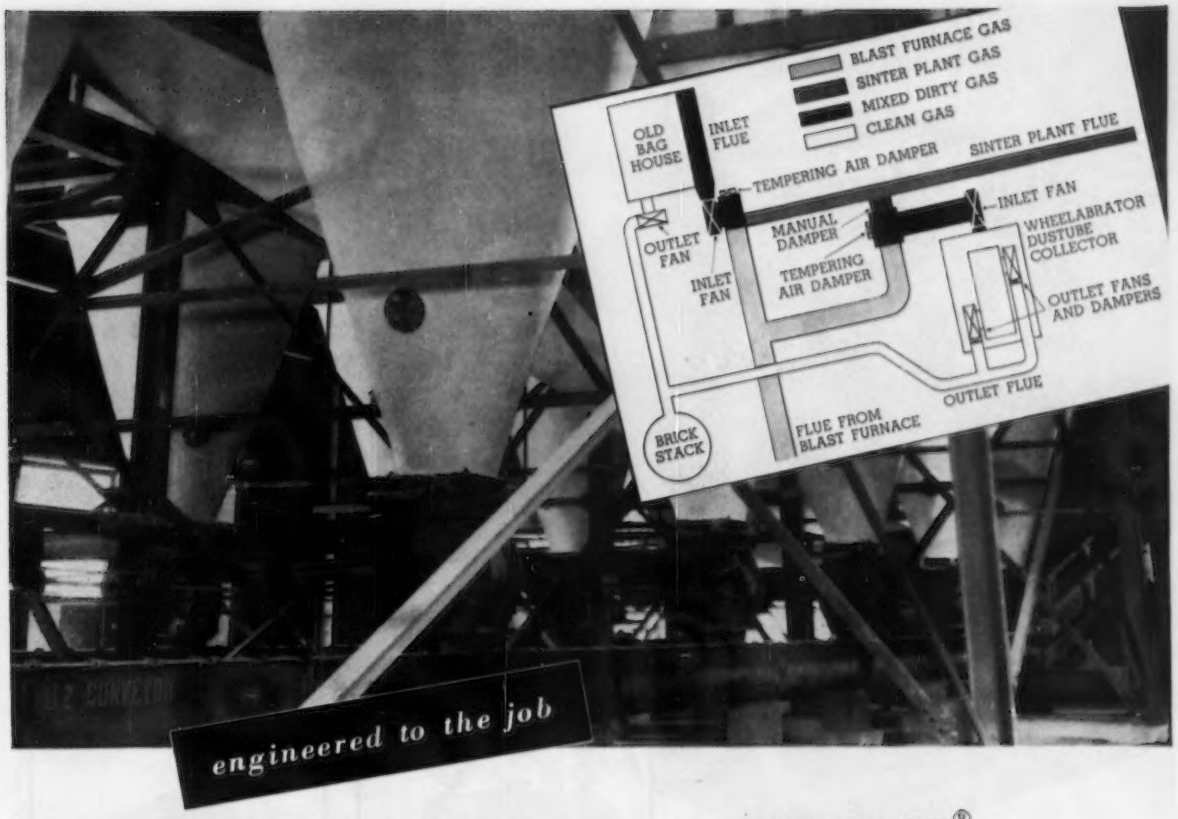
Annual Reports *(Continued)*

Magma Copper Co., Inc. mined and milled 433,073 tons ore and recovered copper, 54,185,953 lb; silver, 623,806.40 oz; and gold, 12,024.366 oz. Three lessees mined and shipped 17,596 tons manganese ore. San Manuel mine and mill construction was ahead of schedule and will be completed in December 1955.

New Jersey Zinc Co. Franklin mine was closed down after operating over 100 years. Sterling Mine development on schedule and will be completed in 1955. Friedensville, Pa. dewatering has proceeded far enough to permit start of underground development. Austinville, Va. development was completed and productive mining is underway. Ivanhoe completed surface shaft and started drifting to join Austinville tunnel. Mineral is being unwatered. Jefferson, Tennessee mine scheduled for production in 1956. Company holds share in Quebec Iron and Titanium Corp.

Outokumpu Corporation, a Finnish government-owned mining company, produced 21,365 tons of copper during 1954. Other products include iron pyrites, zinc, lead and wolfram concentrates. Small quantities of gold, silver, platinum and other metals also were produced.

A new zinc mine went into production at Vihanti and operations were begun at the Keretti shaft of the Outokumpu mine during the year.



WHEELABRATOR® DUSTUBE® Collector

eliminates air pollution — cleans flue gas

Increase in sintering capacity, at a prominent lead smelter, necessitated an addition to the standard baghouse collection system for the filtering of flue gas from sintering machines and blast furnaces . . . and the salvage of this valuable material.

After visits to other smelters and checking on many systems, plant officials chose a Continuous Automatic Wheelabrator Dustube collector with Orlon fabric filter tubes.

The collector installed is a 12-compartment, continuous operation model. While tubes in 11 compartments are filtering, those in the 12th are shaken to drop collected material into screw conveyors for return to the sintering plant. Each succeeding compartment is automatically shaken in turn.

The Wheelabrator Collector was engineered into the existing system and no additional operating personnel was required. Capacity was rated at 136,000 cfm. Volumes handled have been as high as 150,000 cfm. Much improved smoke conditions have been maintained at the blast furnaces and in the plant generally and valuable material has been reclaimed. The Orlon tubes have shown no wear in a year.

To better working conditions, increase material recovery and assure a clean stack in your plant, investigate the high efficiency of Wheelabrator cloth filter systems.

Write today for your copy of Catalog No. 372 for further information.

American WHEELABRATOR® *top efficiency in dust collection*

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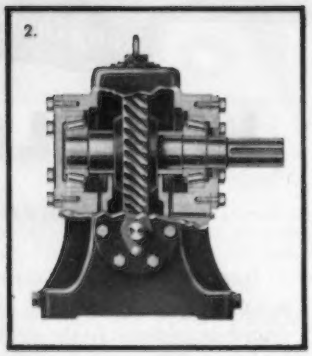
STURDY
RUGGED
EFFICIENT
LONG LIFE
LOW UPKEEP

precision built

HEAVY DUTY WORM REDUCER



1. Heavy Duty, Type "AT" Reducer, showing the rugged worm and shaft construction; generous ball bearing mountings, and the easy-to-get-at, leak-proof stuffing box.

2. Same Reducer, showing section through worm wheel shaft. Note generous spread of roller bearings, and efficient design of oil wells surrounding bearings.

. . . and we really mean "Precision Built,". . . in fact, we have put as much research, design and skill into these heavy duty reducers, as is put into the finest time-pieces or scientific instruments.

In order to assure the user of Long, Efficient Service Life with lowest possible maintenance, materials and manufacturing standards are very rigidly maintained at "Phillie Gear":

Worms are of alloy steel with carburized hardened and tempered threads; shafts and threads are precision ground and polished after heat-treating.

Worm Gears are made from highest quality chilled-cast nickel bronze.

Housings are oil-tight quality grey iron . . . designed to assure maximum rigidity and heat radiation, with ample oil reservoir.

Units are available with Worms above or below the Worm Gear; also with shafts up or down for Vertical Drives.

A complete range of sizes is available to cover any application up to 265 H.P., with ratios from 3-5/8:1 to 6300:1. They are built to provide efficient and dependable power transmission under the most rigorous conditions over a long period of time.

For detailed information write for latest catalog WG.

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Industrial Gears & Speed Reducers
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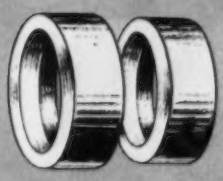
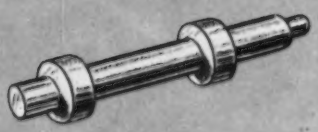
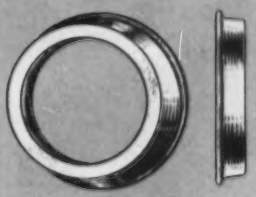
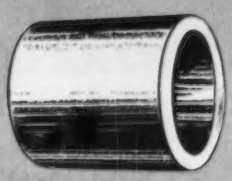
Established 1892

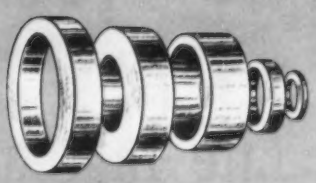
FOR HEAVY EQUIPMENT PARTS... MIDVALE


ROLL SHELLS


FORGED SHAFTS


TIRES


HEAVY FORGINGS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Midvale's complete facilities for making carbon, alloy and stainless steel forgings and stainless steel castings offer you a dependable source of supply for maintenance parts on your heavy equipment. Midvale engineers' knowledge and vast experience in designing and forging parts for mining and rock products equipment is available to help you solve your operating maintenance problems. Next time ask for Midvale's engineering and metallurgical service.

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MIDVALE

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Mixer Blade Life Increased 19 Times

by **Hard-Facing**

Blades hard-faced with HAYSTELLITE tungsten carbide rod have been in operation for 20 months—and are still in good condition. They have mixed 36,000 cubic yards of concrete while operating 3 shifts a day, 6 days a week. Unprotected cast steel blades had to be replaced every 4 to 5 weeks while operating under the same conditions. More than 19 shutdowns have been eliminated by hard-facing, and repair and replacement costs have been cut sharply.

Big savings like this are not unusual when HAYNES hard-facing products are used to prolong the life of equipment. These wear-resistant materials give outstanding service when used to protect conveyor screws, buckets, crushers, tractors, and other equipment exposed to abrasion, corrosion, impact, or heat.

Your local dealer carries a complete line of HAYNES hard-facing alloys, including HAYNES iron and nickel-base rods, HAYNES STELLITE cobalt base rods, and HAYSTELLITE tungsten carbide tube rod. Ask him for descriptive literature. If you don't know the location of your local dealer, write to Haynes Stellite Company, a Division of Union Carbide and Carbon Corporation, Kokomo, Indiana.

See... **Your local Haynes Stellite Dealer**

or

Write... **to Haynes Stellite Company**

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A *sure* way to lower costs, boost *production* and *profits* is to mine your materials with the most *efficient* equipment. Whether you're stripping and casting, digging a high bank or working below the surface, there's a Lorain to do the job better... because Lorain has developed special machines to closely match the needs of mining men. Here are three examples ... proof that wherever you dig, there's the right machine in the complete Lorain line.

ON TOP OF THE CUT...

Lorain Crawler Draglines include many special features for most efficient digging and casting of overburden. Long-wide crawlers give maximum flotation on soft ground, prevent "nosing-in," help keep production high. Fast, snappy swings cut minutes from cycle time and "Cable-Miser" Fairleads add to cable life and reduce costs.

DOWN IN THE PIT...

Bank cuts call for shovel digging and, again, Lorain has met the special needs of mining men. A typical example is shown in the photo, a Lorain Shovel with 34 ft. boom, 27 ft. stick and 1¾-yd. dipper. These long-range stripping booms and dipper sticks make a full pass when digging high bank cuts, loading heaped buckets with a complete bank mix. Long-range booms (as illustrated) cast spoil further back and higher up, reducing the number of shovel moves. If it's a shovel job, there's the *right* Lorain for your mine... in capacities through 2½ cu. yd.

UNDERGROUND...

Here's another special Lorain design for use where headroom is low. It's a fast-digging, low-clearance loader — the Lorain Scoop Shovel. Equipped with 1¼-yd. bucket, it loads material with a powerful forward, horizontal crowd-motion, can rotate through a full circle for fast spotting and loading with fewer moves.

These are but a few of the machines Lorain has developed to meet the special needs of mining men. Take *your* problem to your Thew-Lorain Distributor. He offers *more* types — *more* selection to fit your mining needs.

A LORAIN. CAN DO IT BETTER

THE THEW SHOVEL CO., LORAIN, OHIO

600 TONS PER HOUR

is a tough test - even for the Best!

Upper photo shows Alcoa's 42" x 36" Homer Hercules extra-heavy duty permanent magnetic pulley installation, one of the world's largest. This Homer pulley drives the 200' long, 20% troughed slope conveyor, which travels 300 feet per minute, moving bauxite ore at the rate of 600 tons per hour. Slope on the conveyor is 3⅛' per 12' length. This is one of nine Homer magnetic conveyor units installed in this plant.

Like ALCOA–HOMER is interested in offering industry only the finest. Homer permanent magnetic separators have proved their ability time after time to perform effectively and efficiently, far beyond normal requirements.

Homer permanent magnetic pulleys and Homer cross belt magnetic separators are pacing Alcoa's tough conveying and automatic tramp iron removal jobs at their Mobile, Alabama plant.

If you are planning to use automatic magnetic separation equipment, it will pay to get the facts on Homer Magnetic Separators . . . the separators designed and built to give years of profitable service under unusual and extreme conditions. Let HOMER help solve your tramp iron problems–write us today.

THE HOMER MANUFACTURING CO., INC., DEPT. 170, LIMA, OHIO

HOMER . . . *the FINEST in Permanent Magnetic Equipment for Industry*

GM DIESEL
CASE HISTORY No. 1A3-16

OWNER: Crowe Coal Company, Kansas City, Mo.

INSTALLATION: Six GM Diesel-powered Dart trucks . . . three 20-ton rear-dumps and three 40-ton bottom-dumps. GM Diesel-powered Bucyrus-Erie #38-B shovel with 2¼-yard bucket. The company also operates three 20-ton bottom-dumps powered with 4-cycle Diesels.

PERFORMANCE: GM Diesel-powered trucks have faster pickup, respond to throttle controls better, use less lube oil. Engines take less time—cost less to overhaul. Shovel strips 1000-1200 tons of coal in 7¼ hours—burns 4 gallons of fuel per hour.

Quicker Pickup-Faster Hauling

MISSOURI's Crowe Coal Company operates nine trucks—six powered by General Motors 2-cycle Diesels and three with 4-cycle Diesels. They report the GM Diesel-powered trucks "respond quicker, use less lube oil, are easy to overhaul."

A General Motors Diesel does "respond quicker." It gets more work done than most engines, partially because of its 2-cycle "power on every piston downstroke" design. It costs less to buy. It costs less to maintain because GM Diesel replacement parts cost less (valves up to 62% less and cylinder liners up to 40% less) than parts for comparable Diesels.

Today you can get GM Diesel power in more than 750 different models of equipment built by over 150 manufacturers. Call in your local GM Diesel distributor or write direct for more information.

It Pays to Standardize on

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DIESEL POWER

DETROIT DIESEL ENGINE DIVISION
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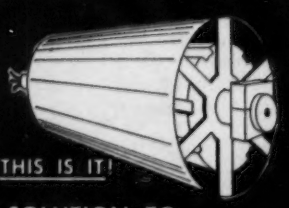

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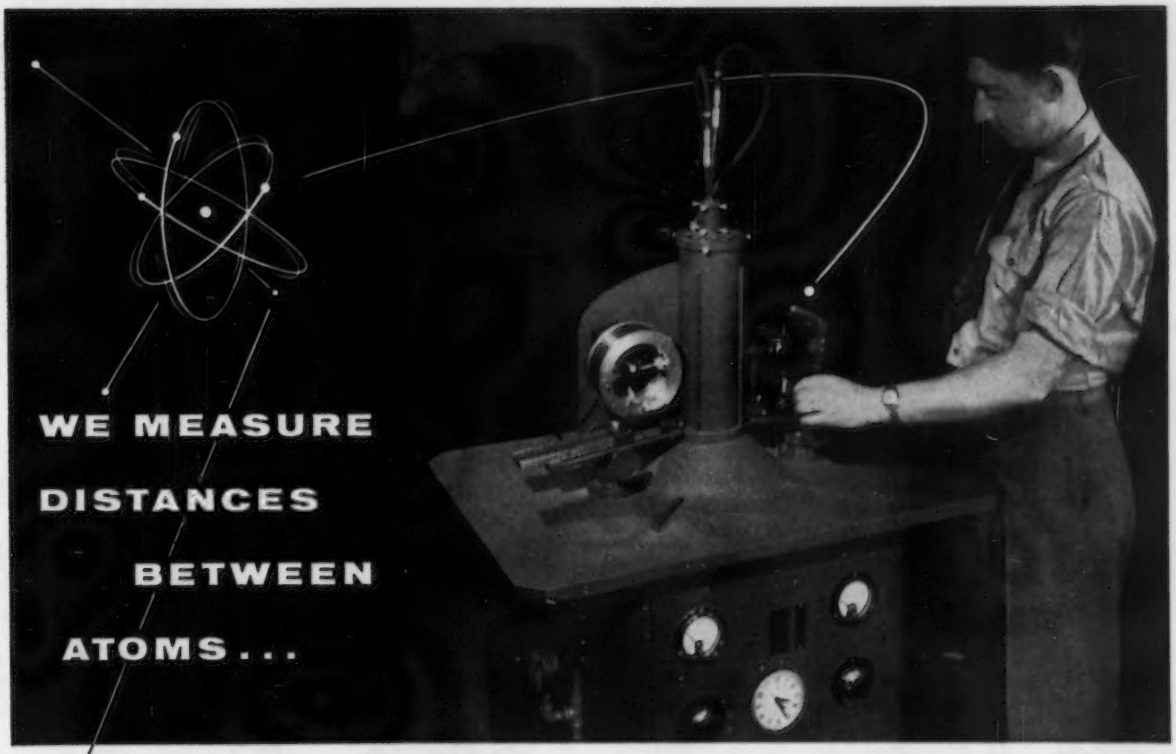

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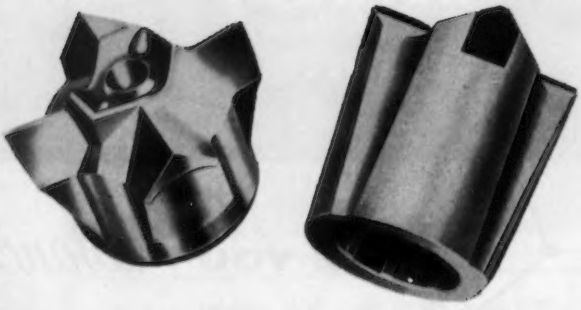

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. . . and feed leg drilling machines . . . you just can't beat this speedy, cost cutting combination! Designed for efficient, low cost operation, Liddicoat is the bit that is used-to-destruction and then discarded . . . no resharpening . . . no delays . . . no extra costs . . . the ideal bit for easier drilling with feed leg machines.

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. . . as shown at right above, is a tungsten carbide insert bit designed for on-the-job interchange with Liddicoat used-to-destruction bit . . . both fit the same drill steel. Now, you can switch to the most economical bit—right on the job—on the same steel—to meet varying ground requirements. No delay whatever!

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Down went the overhanging rocks ...and the cost of getting them down!

REMINGTON INDUSTRIAL GUN Cuts $85.00 job to $9.50 at quarry

"It used to cost us about $85 each time we had to remove overhanging rocks from our quarry—now with a Remington Industrial Gun we do the whole job for $9.50." That's the report from a zinc mine in Alabama.

Savings like this are common. The Remington Industrial Gun saves hours of hazardous work . . . can be aimed, loaded and fired in seconds. Mount it on a truck, a tripod or a mobile chassis. Set it up in any part of your mine or quarry. You'll find real versatility in this fast, safe way of removing obstructions. The U.S. Bureau of Mines, for example, has used it for dislodging large icicles at distances *up to 200 yards!*

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1. Technicians available for geological appraisals, development, mechanized production.
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New Employment Opportunities Section for Displayed ads starting July issue. For details see announcement ad in this section.

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The advertising rate is $13.80 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42 St., N. Y. 36, N. Y. For July Issue closing June 17th

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Well established chemical manufacturer offers unusual opportunity in highly responsible position. Man will function as internal consultant with broad duties in company beneficiation operations. Will be headquartered in midwest. Salary open—in five figure bracket depending upon man's background and experience. Age 30 and up. Bachelor's degree in metallurgical engineering or Minerals Beneficiation required. Applicants must have minimum of seven years experience preferably with non-metallics. Those whose current salary is less than $7500 need not apply. Send detailed description of all work experience including salary progression. All replies confidential.

P-6611 Engineering & Mining Journal
520 No. Michigan Ave., Ch'go 11, Ill.

MINING ENGINEER

Outstanding opportunity in highly responsible position with well established midwest chemical manufacturer. Broad duties. Man will function as internal consultant in all phases of company mining operations. Salary open—in five figure bracket, depending upon man's background and experience. Age 30 and up. Bachelor's degree in mining engineering required. Applicants must have minimum of seven years mining engineering experience in underground or open-pit operations. Those whose current salary is less than $7500 need not apply. Send detailed description of all work experience including salary progression. All replies confidential.

P-6609 Eng. & Mining Journal
520 No. Michigan Ave., Ch'go 11, Ill.

GEOLOGIST—CUBA

To carry out a large scale geological reconnaissance and examination of mineral prospects. This is a responsible job which offers considerable challenge and opportunity. Latin American experience or ability to speak Spanish is required.
Please send a detailed resume. Replies will be held confidential.

Manager of Mineral Exploration
FREEPORT SULPHUR COMPANY
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New York 17, New York

REPLIES (Box No.): Address to office nearest you
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CHICAGO: 520 N. Michigan Ave. (11)
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POSITIONS VACANT

Metallurgical engineer: Young, recent graduate who is interested in the beneficiation of non-metallic. Man selected will be in charge of control laboratory, responsible for operating metallurgy and direct testing and research. 1200 ton per day mill. Utilizing flotation. Location South. P-5837, Engineering & Mining Journal.

Graduate engineer thoroughly experienced open-cut mining preferably with Latin-American operating background needed for preparation estimates later operation location South America. Salary open. Send full professional record, salary desired, references P-6189, Engineering & Mining Journal.

Graduate Engineer to manage Mining Property producing two hundred tons per day, located in the Andes of Southern Peru. Must speak Spanish, preferably Latin-American operating experience. P-6207, Engineering & Mining Journal.

Wanted — Metallurgical Engineers. Graduating and experienced for research, plant control, and pyrometallurgy. Location — Lake Superior District. Reply will be held confidential. Include age, education, experience and salary requirements. P-6549, Engineering & Mining Journal, 520 N. Michigan Avenue, Chicago 11, Illinois.

Position open for young man with chemical, metallurgical or mining engineering background as assistant to head of metals and ores department. Give full details as to education, experience and salary required. Good future for right party. P-6629, Engineering & Mining Journal.

POSITIONS WANTED

Mining engineer, 25 years Successful and progressive Foreign and Domestic Mining Operations. Available as Manager or Superintendent. PW-1622, Engineering & Mining Journal.

Metallurgical engineer desires responsible position with progressive company in development of processes and/or equipment in mineral processing field. 13 years experience in mineral dressing, mainly in research and development. PW-6654, Engineering & Mining Journal.

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(Continued on following page)

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PW-6196 Eng. & Mining Journal
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Age limit about 45. Must be graduate metallurgist having operating experience and with aptitude and experience in laboratory research and process development. Heavy sulphide ore experience desirable. Qualified to succeed to superintendency.

ASSISTANT MINE SUPERINTENDENT

Age 30-42. Must be tactful and adaptable. Require man with excellent mining engineering training. Some operating experience necessary.

ASSISTANT CHIEF ENGINEER

Age limit 45 preferably about 35. Must be graduate mechanical, chemical or civil engineer with natural mechanical ability, excellent practical and supervisory and some construction experience, for charge under Chief Engineer of all shops, foundry, mobile equipment including loading, marine, railway and construction; maintenance and repair of all types of equipment; 7250 KVA diesel generating plant.

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Age limit 48. Should be competent supervisor with practical ability required to operate local mine shops and surface equipment and to routinely maintain surface and underground equipment. Local facilities backed up by heavy duty general shops for major repairs.

Forward with initial reply complete educational and experience records, list of references, age, marital status, number and age of children, photo (optional). Company offers three year contract, furnished house, transportation self and family, liberal vacations. Excellent climate, living conditions, medical and hospital facilities. School to 14 years. Non-contributory pension plan. Salary open.

P-6192 Eng. & Mining Journal
1111 Wilshire Blvd. Los Angeles, Calif.

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MINING ENGINEERS

EXPERIENCED IN
UNDERWATER PLACER MINING
EIGHTEEN MONTHS CONTRACT
SOUTH AMERICA
When applying send names and Addresses of previous employers

Apply: ST. JOHNS TERMINAL CO.
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At our uranium plant near Bluewater, New Mexico, who is experienced in industrial safety work, fire protection matters, plant security arrangements, and related personnel questions. A man of this type would also have certain duties in connection with our outlying mining operations, which are largely open-pit work, using power shovels and large trucks. For a properly qualified man adequate housing will be available at a normal rental.

This is a fairly large and rapidly expanding operation and the right man, who is interested in this aspect of mining and milling operations, would find himself fully occupied in a very interesting job. The salary is open, depending upon experience and qualifications.

ANACONDA COPPER MINING CO
New Mexico Operations
P. O. Box 638
GRANTS, NEW MEXICO

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Top level engineering position with prominent company manufacturing varied line of chemicals. Will have broad responsibility for administration of several engineering departments and will assist in formulating engineering policies. Midwest location. Salary open—those currently earning less than $10,000 will not be considered. Age 35 and up. Bachelor's degree in mining engineering required. Applicants must have minimum of ten years mining engineering experience and good knowledge of chemical engineering techniques. Submit detailed resume including salary progression. All replies confidential. Write

P-6607 Engineering & Mining Journal
520 No. Michigan Ave., Ch'go 11, Ill.

WANTED:
Qualified Assistant Mine Superintendent

Want man with broad mining experience, acquainted with square set stoping. Must be able to handle labor, 1,000 ton per day operation. Graduate engineer preferred, age 35-45. Housing furnished, excellent climate, location southeast, salary commensurate with ability. Full record required in first reply. *Write*

P-6570
Engineering & Mining Journal
330 W. 42nd Street
New York 36, N. Y.

WANTED
Chemist or Assayer

For analytical work on tungsten ores and concentrates. Previous experience necessary. Location—southeast.
P-6691 Engineering & Mining Journal
330 W. 42 St., New York 36, N. Y.

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MINERAL INDUSTRY
(GEOLOGY, MINING, METALLURGY)

The Li Foundation, Inc. has established two post-graduate fellowships of $2,000 each, for 1955-56, leading to a Master's Degree at The Mackay School of Mines. They are open to citizens of the United States, and may be renewed for a second year.

Send letter containing names and addresses of 3 references, statement of academic and professional record, and recent photograph to: Vernon E. Scheid, Dean, Mackay School of Mines, University of Nevada, Reno, Nevada.

BUSINESS OPPORTUNITIES
(Continued from preceding page)

Well established quartz miner with 35 years experience wishes to contact capital, object partner basis, the purpose, to further develop mine, wonderful opportunity for metallurgist also on partnership basis mine developed to a point where it's ready for a pilot mill, copper, silver, gold and lead. P. O. Box 505, Philipsburg, Montana.

Gold Placer Mine Two lava capped ancient channels in one of California's richest placer districts. Millions were taken from neighboring mines in "The Early Days". Virgin ground. Complete data, reports, maps, etc. from competent engineers. Quick operation, attractive deal. Volcano Placers, 1744 E. 19 St., Oakland 6, Calif.

Mercury, Pure, steel flasks, 500 month. 1008 So. Burnside, Los Angeles 19, Calif. WH 2452.

WANTED

ANYTHING within reason that is wanted in the field served by Engineering & Mining Journal can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

Attention . . .
EMPLOYMENT ADVERTISERS

Effective with the July issue, a new section will start in ENGINEERING & MINING JOURNAL. We will head this section: EMPLOYMENT OPPORTUNITIES. All Displayed Employment Opportunity advertising will be placed in this new section, with the exception of those advertisers who contract for run-of-book position. New advertisers will be billed at the rate of $16.00 per inch, unless on contract. Contract rates furnished on request. Advertisements are subject to Agency Commission.

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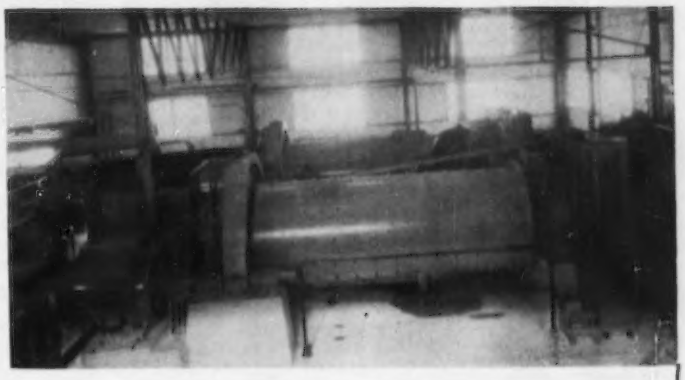

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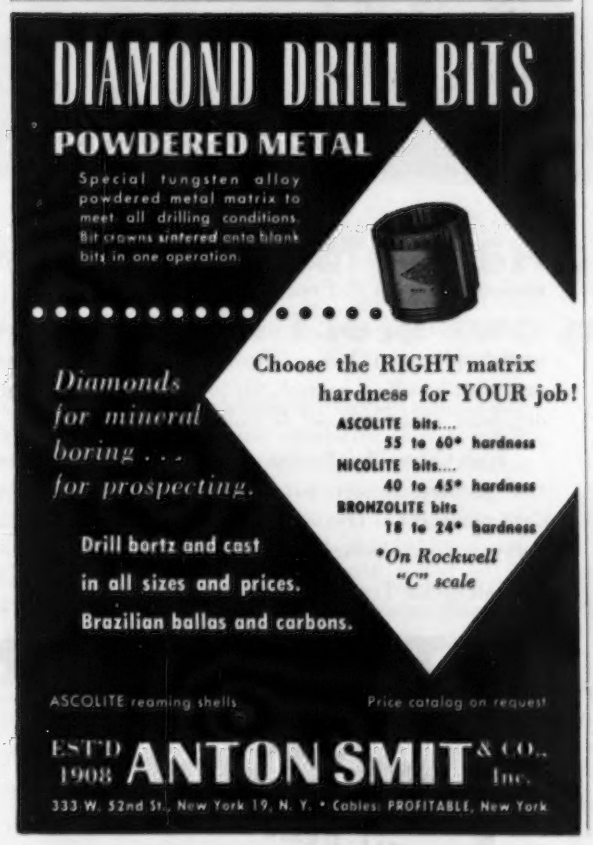
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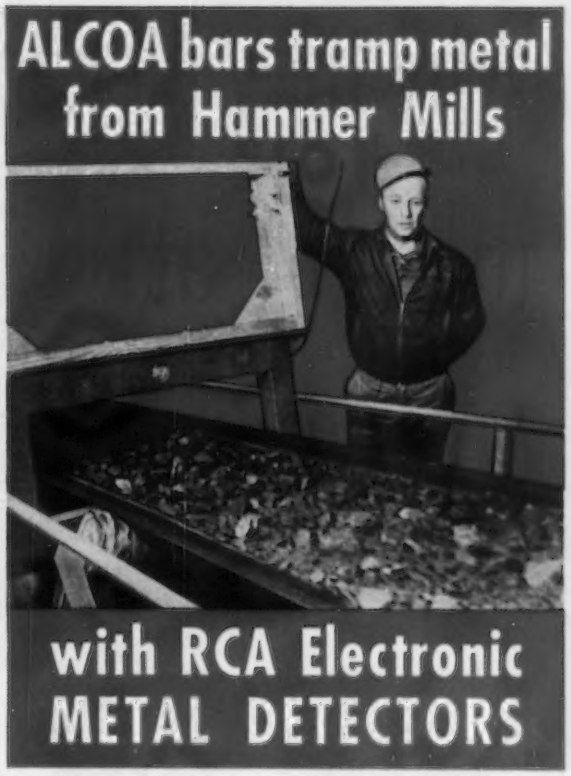

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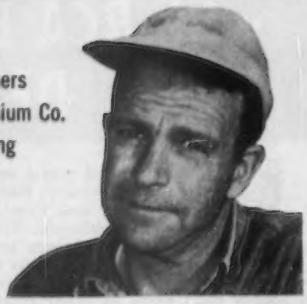

Everett J. Robinett is one of five partners in Dove Creek Uranium Co. Another hard-working "partner" is this Caterpillar HT4 Traxcavator.

"We chose the Caterpillar HT4 Traxcavator because we had a mighty rough job to do and we knew Cat could do it," says Everett J. Robinett, a partner in Dove Creek Uranium Co. Their mine, Atomic King No. 2, is 30 miles southwest of Moab, Utah, site of the first uranium bonanza.

"We've owned Caterpillar machines before," Mr. Robinett continues, "so we know what they can do. Another factor is the service we get from our Caterpillar Dealer."

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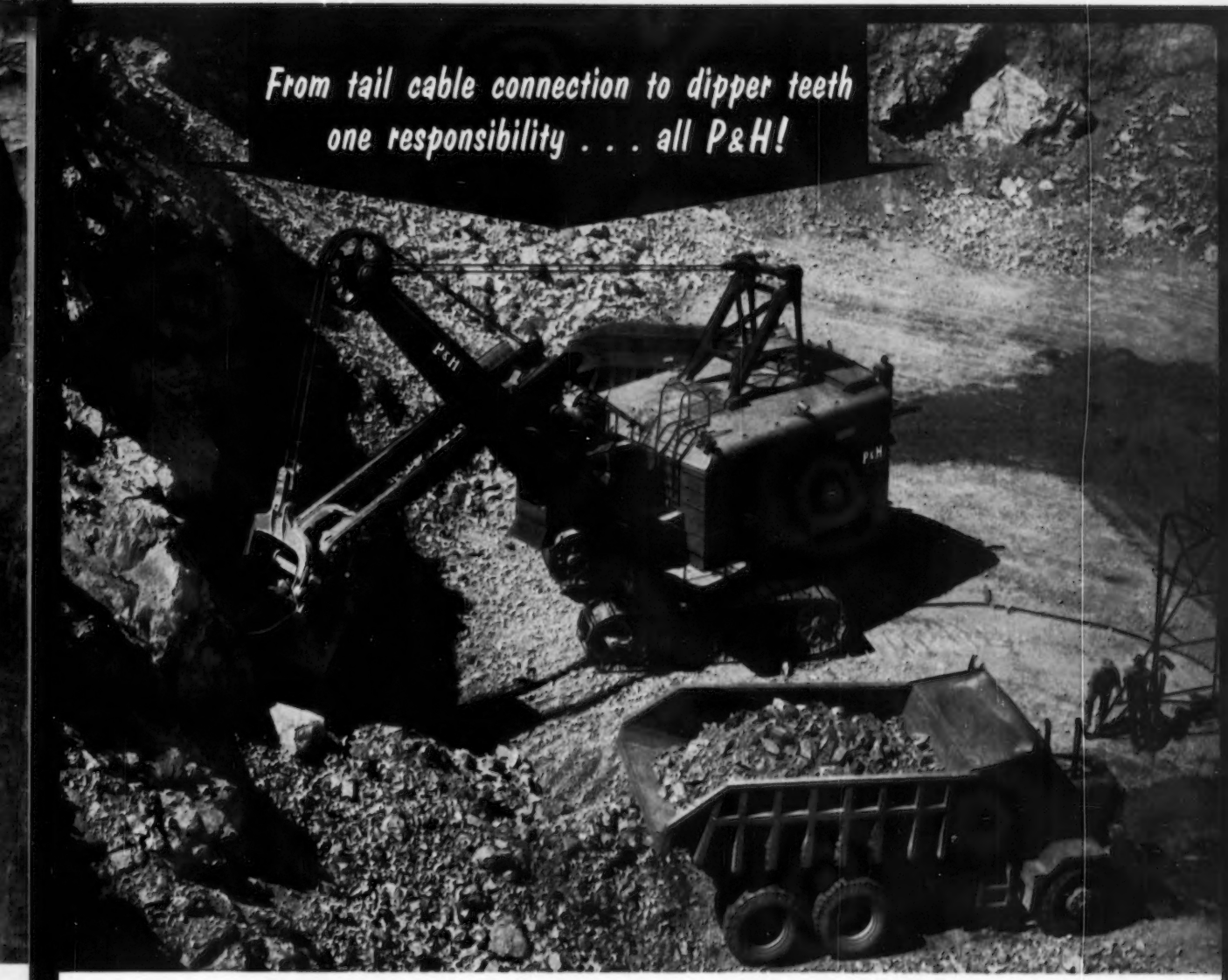

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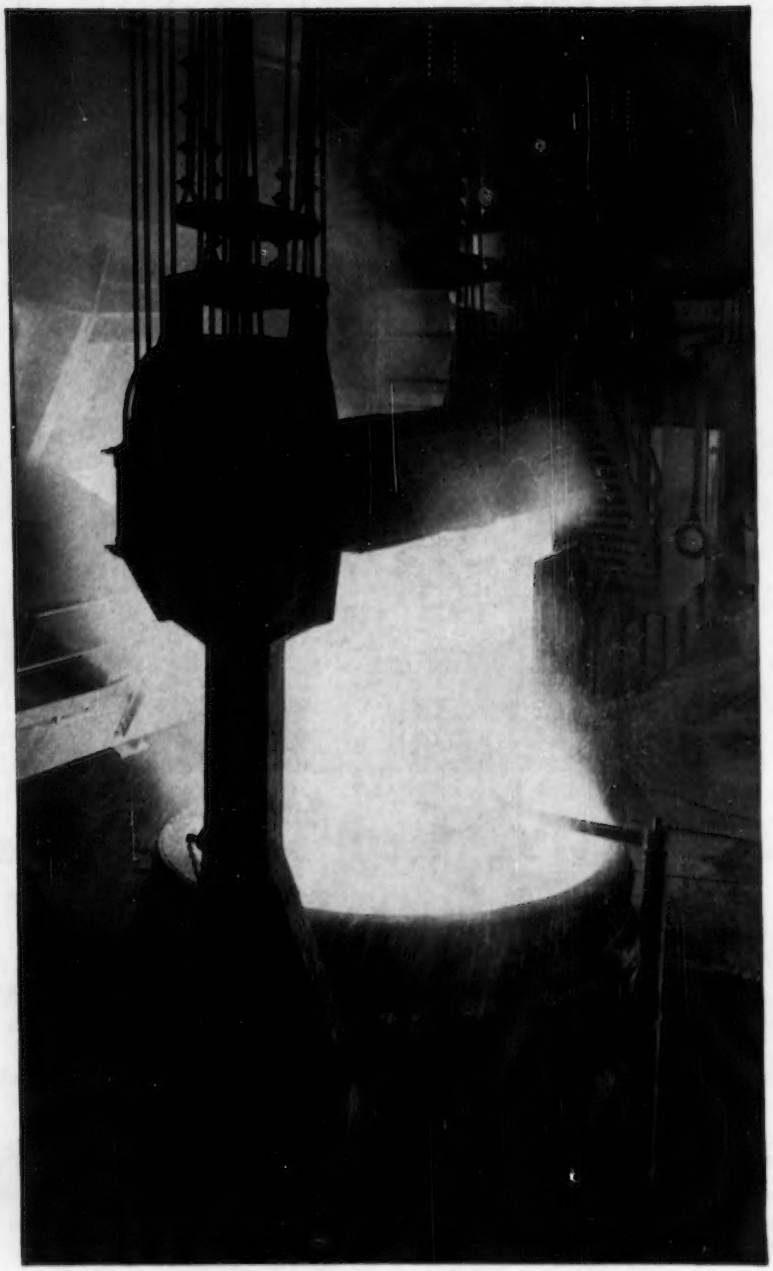

NICKEL makes steel tougher. So, our steel-making specialists don't skimp on nickel in the fine alloy steel we make for Timken® tapered roller bearings. They use exactly the right amount of nickel to give these bearings the toughness they need to withstand shock and last longer. Exacting quantities of chromium or molybdenum or both guarantee uniform hardness. By using the steel industry's first direct-reading spectrometer, we exercise hairline control of each element at the precise instant of tapping the furnace.

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